Geotech Drilling Services Pty Ltd

QBSA Site Classification Licence No. 740483
• Site Investigation & Classification • On-Site Sewerage Assessment & Effluent Disposal Design
36 Mirbelia Street Everton Hills Qld 4053 Phone (07) 3355 1552 Fax (07) 3355 1975

Residential Site Assessment & On-Site Sewerage Facility Design

Date:	28/3/08
Job No.	2503
Job Commission:	Dr Les Dawes QUT Civil & Environmental Engineering Senior Lecturer School of Urban Development GPO Box 2434 Brisbane Qld. 4000
Site Address:	[redacted]
Local Authority:	Pine Rivers Shire Council
UBD Map:	106 L18
Real Property Description:	Lots 42 to 45 on S3149, Parish of Samford, County of Stanley.
Project:	Existing Building Septic System Change Over to a Secondary Treatment Plant System

As requested a site visit was conducted on 12th December 2007 to assess suitable alternatives for the disposal of household waste water effluent.

The site and soil evaluation was carried out in accordance was carried out in accordance with the following Codes of Practice: -

- AS1726 – 1993 "Geotechnical Site Investigations"
- AS1547 – 2000 "On – site domestic–wastewater management"
- 2006 "Queensland Plumbing and Waste Water Code".

Les Dawes provided the following relevant documentation: -

- Site plan
- Survey Plan
- Building floor plan

A Biolytix Secondary Treatment Plant System is to be utilized on this project.

Contact: Carl Conran
Mobile: 0412 67 25 14
Email: cconran@bigpond.net.au

1.0 Site Evaluation and Assessment

• Local Environment

This block of land is an acreage property set on the side rise of a hill the Pine Rivers suburb of Camp Mt. The proposed residence is to be positioned towards the rear of the property. The proposed land application area is to be positioned towards rear of the building site area. There are no dams or permanent water courses within 30m of the land application area. Refer to the site assessment plan for details.

• Site Conditions and Observations

At the time of the site assessment the following site conditions were observed:-

Weather:	Summer, warm and moist.
Surface conditions:	Moist, sand soils.
Vegetation:	Tall grasses and trees.
Slope:	Slight.
Drainage:	Fair.

• Soil Profile

Visual inspection of cut banks was used to examine the typical soil profiles. A summary of the profiles is as follows and depths are mm:-

00 - 150	(SM) Gravelly Clayey Sand, Dark Brown, Dry, Loose.
150 - 450	(SC) Clayey Sand Pale Brown, Damp, Medium Dense.
450 - 800	(CH) Sandy Clay, Orange/Brown, Moist, High Plasticity.
800 - 1200	(XW) Weathered Rock, Decomposed Granite
1200 -	Borehole Termination

• Groundwater

No pooling of water on the ground surface on the ground surface and no shallow sub-surface table was encountered while test bore drilling.

• Hydrology

This property is situated in a well vegetated and hilly area of Camp Mt in the Pine Rivers Shire. The following table provides a summary of monthly and annual precipitation and evaporation data from the Samford CSIRO weather station for the Bureau of Meteorology.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Mean (mm)	161.8	162.3	135.0	96.9	79.1	60.1	55.6	33.0	43.7	82.7	94.9	124.6	1129.8

Table 1 – Mean Monthly Precipitation

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Mean (mm)	164.3	131.6	133.3	102	77.5	72.0	77.5	102.3	132	151.9	171.0	182.9	1498.5

Table 2 – Mean Monthly Evaporation

The monthly and annual average precipitation is not excessive. The proposed site for the effluent disposal is open, well drained and has high evapo-transpiration capabilities.

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2.0 On-Site Sewerage Facility and Land Application Area Design

• On-Site Sewerage Treatment System

Type of system to be used: A secondary quality "All Waste Treatment System" (AWTS) authorized for use by the Department of Natural Resources must be utilized to treat domestic strength waste water only.

• Soil Design Parameters

From AS1547- 2000, TABLE 4.2A4 the design irrigation rate (DIR) is as follows:-

Soil Category	Soil Type	Structure	Indicative Permeability	Design Rate (DIR)	Indicative Drainage Class
4	Clay Loams	Moderately Structured	0.12 m/day to 0.5 m/day	25mm/week	Imperfectly Drained

Table 3 – Design Soil Parameters

• Waste Water Design Flow

Number of bedrooms from supplied residential floor plan **3 with bunk beds**

Design number of persons per day: **10**

Daily per person flow for tank water supply with full water reduction facilities: (AS1547 – 2000, Appendix 4.2D On – Site roof / Tank water supply). **140 L/person/day**

Design daily flow rate (all waste): **1400 L/day**

Total weekly flow rate (all waste): **9800 L/week**

1 Lecture of 50 people / week – Toilet use only * 6L – One visit each **300 L/Week**

• Land Application Area Sizing

Method of waste water disposal to be utilized: **Sub-Surface Irrigation**

Land Application Area (Ai) $= \frac{q_w}{DIR} = \frac{10100\ L/week}{25\ mm/week} =$ **404 m²**

Therefore the min. application area is to be approximately: **400m².**

Refer to the A3 drawing plan for details and a cross-section of the land application area system.

Approximate Equivalent Persons (EP) as per AS1547 – 2000:

10 EP = 14,000 L /Week, Therefore this project is approximately 7.2EP.

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• On-Site Sewerage Treatment System Criteria

This treatment plant must provide secondary quality effluent to the application area and provide effluent compliance criteria of the following:-

Wastewater Effluent	Compliance Criteria for Secondary Quality mg/L
Biochemical Oxygen Demand Suspended Solids Total Nitrogen Total Phosphorus Thermotolerant Coliform (org/100ml)	<20[1] <30[2] <30 <10 <200[3]

Table 4 – Secondary Effluent Quality

• Minimum Setback Distances

The following Table 5 provides minimum standard separation distances between the AWTS and land application facility based on the quality of the treated effluent from the treatment unit.

Element	Separation Distance (m) Secondary Effluent
Vertical Separation above bedrock	0.6m
Horizontal Separation to a dam, water bore or permanent water course	30m
Horizontal Separation to property boundaries	2m When higher than the disposal facility 4m When lower than the disposal facility
Horizontal Separation to swimming pool	6m
Horizontal Separation to dwelling or children's area	2m When higher than the disposal facility 4m When lower than the disposal facility
Horizontal Separation between a secondary treatment plant and an in-ground potable water tank	6m
Horizontal Separation between the land application area and an in-ground potable water tank	15m

Table 5 - Separation Distances

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3.0 Recommendations

The following is recommended: -

- An authorized AWTS to be utilized.
- Level of effluent quality to be secondary.
- The hydraulic land application area is to be no less than **400m²**.
- The land application area is to be positioned at the rear of the building site area as per the on-site sewerage facility plan.
- The land application area has been designed to be irrigated under turf or a mulched garden bed.
- The sub-surface irrigation system shall distribute the effluent evenly within the design area via a fixed manifold system, with the effluent treatment plant pump to suit the head of the system.
- The pressure compensating dripper irrigation pipes in the land application area must be constructed at level grade and in loose sandy loam 100mm below the ground surface and to the manufactures written specifications.
- Service irrigation line dosing inhibitor and clean filter regularly to manufacturers specifications.
- The land application area must be maintained regularly to encourage plant growth, assist plant evapo-transpiration, and monitor land application performance.
- Provide warning signs near the boundaries of the irrigation area in at least two places, clearly to property users, with wording such as, **"Recycled Water – Avoid Contact – DO NOT DRINK".**
- All on-site sewerage treatment facilities are to be installed, operated and maintained in accordance with the manufacturer's instructions.
- Medicines and antibiotics must not be put down the sewerage system, as this will kill the organisms in the treatment plant.
- The on-site sewerage treatment system is not designed to cope with solids and flows from garbage grinders. Garbage grinders are not recommended.
- The land application area must be protected from infiltration and overland flow from heavy rainfall events. Install catch drains upslope to divert overland flow away from this area. If required sub-soil seepage cut off drains can be installed.
- The land application facility must not compromised by grazing animals, recreational activities, and gardening areas, which may compact the soil or interfere with the function of the facility. The effluent disposal area must be fenced off from farm animals.
- The land application area must not be paved or sealed or subject to vehicle traffic.
- Suitable plant species are to be planted on the down hillside area of the application area and in the retention mound to help assist with water-nutrient take up.

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5.0 Certification

An additional charge applies for the inspection and certification. The land application area irrigation installer must contact Geotech Drilling Services Pty Ltd prior to the land application area being completed so we can inspect it and issue compliance certification. No bare earth is to be exposed on the ground surface. Turf or mulch must be imported and laid on the ground surface.

6.0 Conclusion

The site and soil evaluation data reveals that the most suitable location for the land application area is at the rear of the existing building site area. The land application area must be set out as per the on-site sewerage facility plan and be no less than **400m²**.

The existing septic tank system is to be demolished and disconnected to local authority requirements.

Full water reduction facilities must be utilized with the household plumbing fixtures to reduce the amount domestic household waste. Some water restriction facilities are:

- Shower flow restrictors.
- Duel flushing 6/3 L water closets.
- Aerator faucets on tap outlets.
- Front loaded conserving washing machine and water conserving appliances.
- Flow / pressure control valves on all water outlets.

Secondary treated effluent must be effectively released evenly across the land application area and at a sustainable rate in a manner that achieves the performance requirements of the relevant standard codes.

Refer to the rear of this report for the On-Site Sewerage Facility Plan, Land Application Area Details; Preferred Plant Species recommended to assist in nutrient up-take within high water rated areas and Local Authority Forms

Thank you for the opportunity to be of assistance.

Yours Faithfully
GEOTECH DRILLING SERVICES PTY LTD

Carl R Conran
BE Civil Eng. MIE Aust. RPEQ 7799

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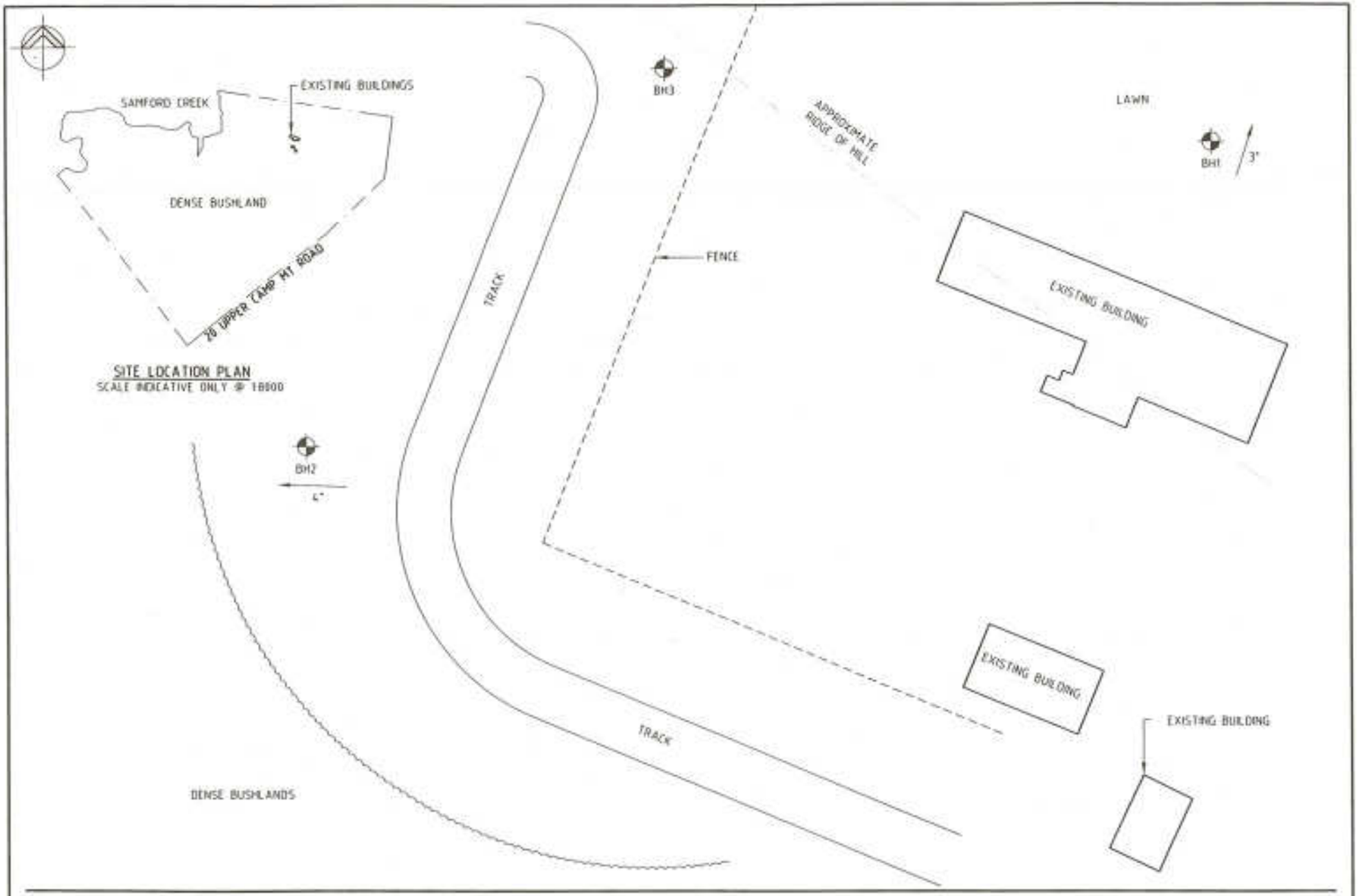

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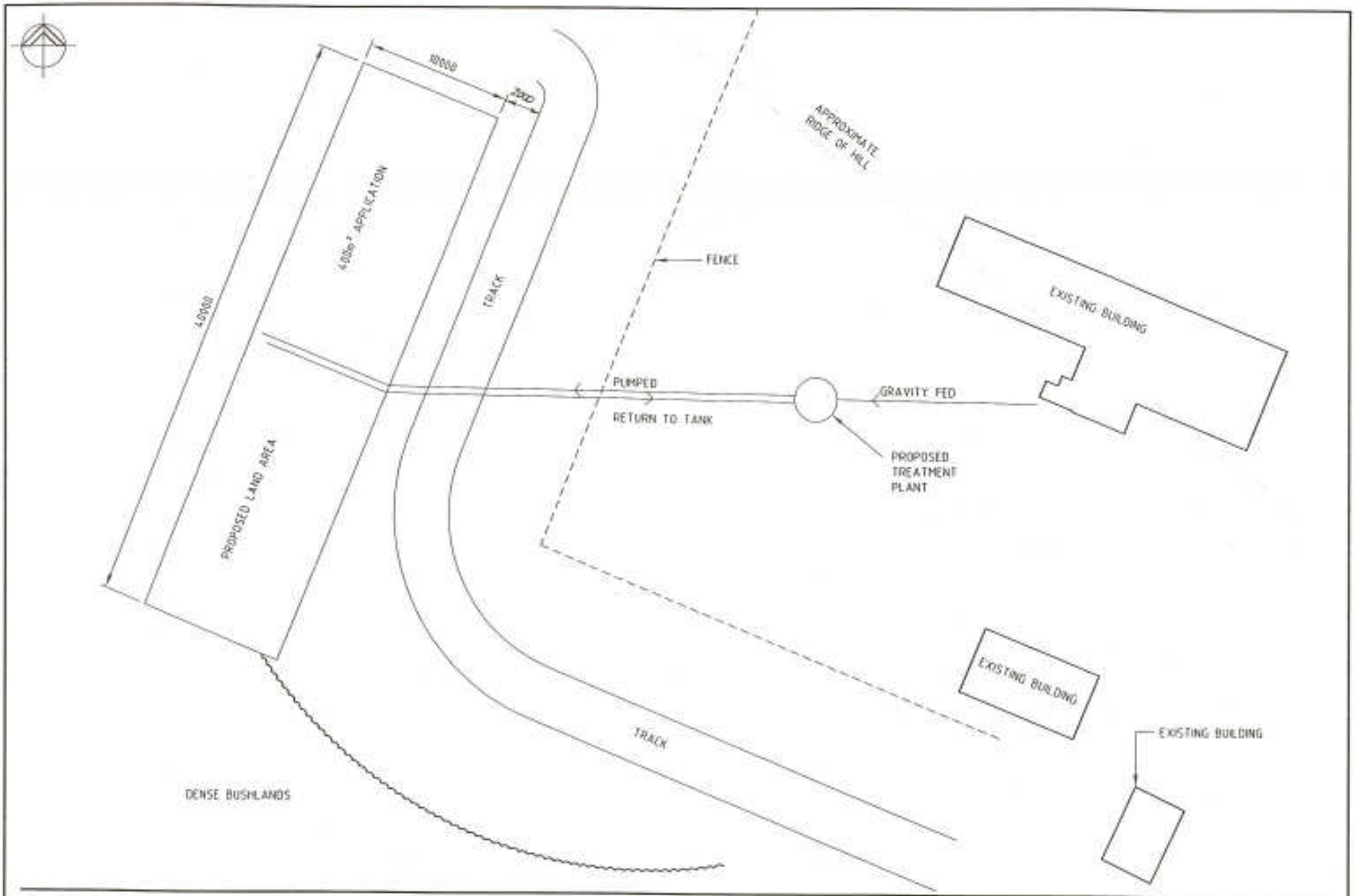
SITE ASSESSMENT PLAN
SCALE INDICATIVE ONLY @ 1:250

			DRAWN: MJTC	DATE: 29/03/06
			SCALE: AS NOTED	ISSUE: A
			JOB No: 2503	SHEET: 1 of 3
A	UPPER CAMP MOUNTAIN RD, CAMP MOUNTAIN RD, QLD 4520	29/03/06		
ISSUE	REVISION	DATE		

CRICOS No. 00213J



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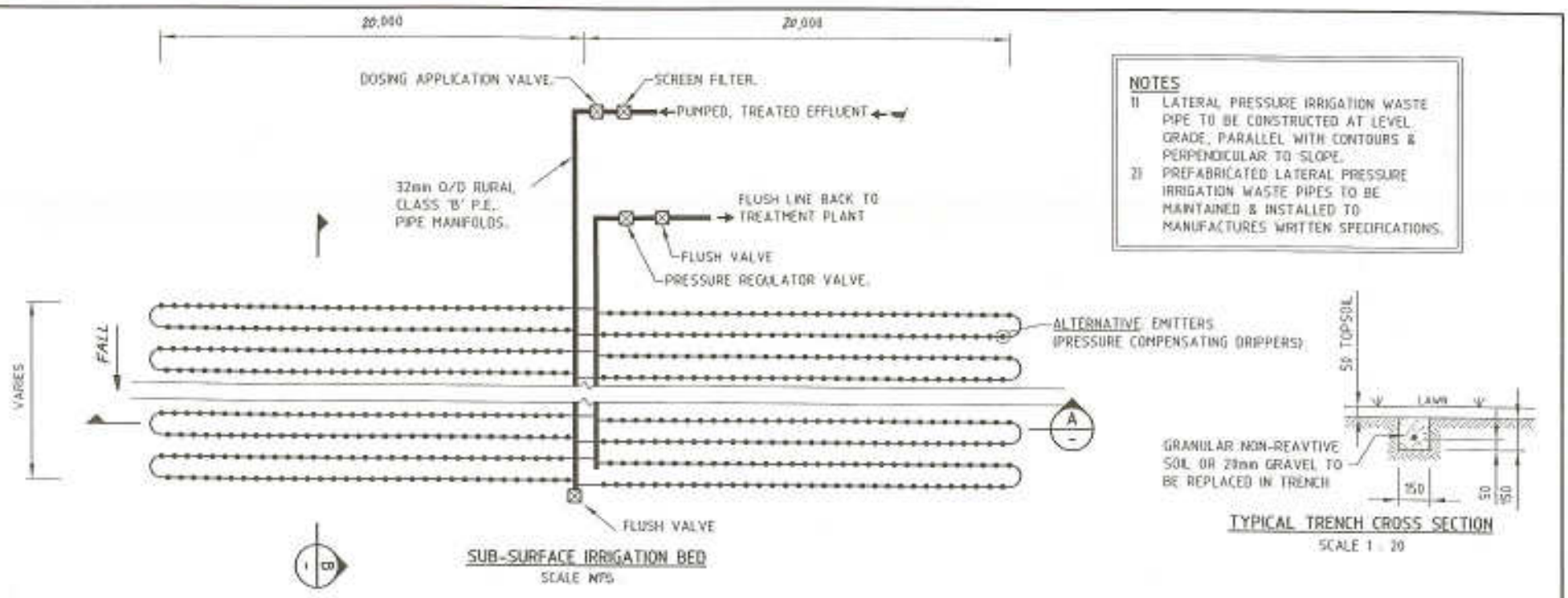
ON-SITE SEWERAGE FACILITY PLAN
SCALE INDICATIVE ONLY @ 1250

			DRAWN: MUTC	DATE: 29/5/08
			SCALE: AS NOTED	ISSUE: A
			JOB No: 2503	SHEET: 2 of 3
A	UPPER CAMP MOUNTAIN RD, CAMP MOUNTAIN RD (S.D.S. #29	11/6/2008		
ISSUE	REVISION	DATE		

CRICOS No. 00213J

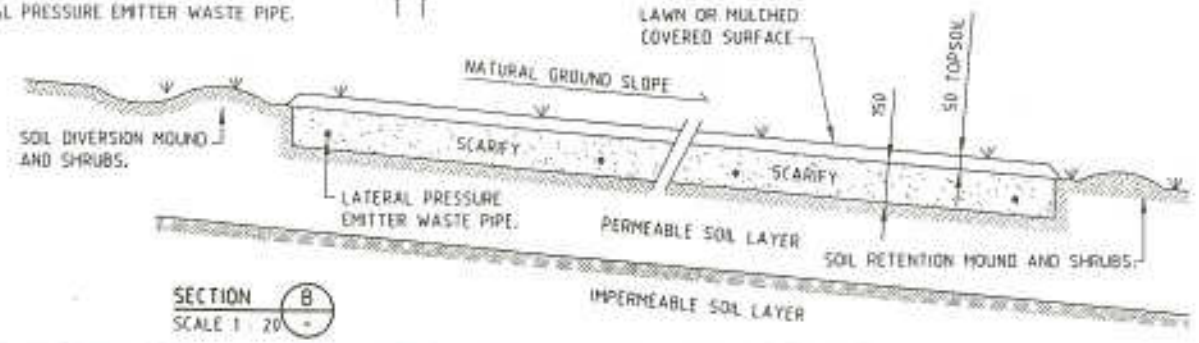


SUB-SURFACE IRRIGATION BED
SCALE NTS

NOTES
1) LATERAL PRESSURE IRRIGATION WASTE PIPE TO BE CONSTRUCTED AT LEVEL GRADE, PARALLEL WITH CONTOURS & PERPENDICULAR TO SLOPE.
2) PREFABRICATED LATERAL PRESSURE IRRIGATION WASTE PIPES TO BE MAINTAINED & INSTALLED TO MANUFACTURES WRITTEN SPECIFICATIONS.

TYPICAL TRENCH CROSS SECTION
SCALE 1 : 20

SECTION A
SCALE 1 : 20



SECTION B
SCALE 1 : 20

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Sub-Surface Pressure Irrigation System

			DRAWN: CC	DATE: 26/3/08
			SCALE: 1 : 20	SHEET:
A			JOB No: 2503	3 of 3
ISSUE	REVISION	DATE		

CRICOS No. 00213J

SUITABLE SPECIES FOR EFFLUENT DISPOSAL AREAS

THE AREA MUST BE COMPLETED WITH PLANTS IN PLACE
PRIOR TO FINAL PLUMBING INSPECTION.

GENUS	SPECIES	COMMON NAME
GRASSES		
BUFFALO		
KIKUYU		
GROUND COVER		
ACANTHUS	*mollis*	
CRINUM	*pedunculatum*	
HARDENBERGIA		
HIBBERTIA	*scandens*	
LONANDRA	*longifolia*	
PENNISETUM	*alopecuroides*	Swamp Foxtail
OPHIOPOGON		
VIOLA	*hederacea*	Native Violet
SHRUBS		
BAECKEA	*stenophylla*	Weeping Baeckea
BAECKEA	*virgata*	
BANKSIA	*robur*	Broad Leaved Banksia
CALLISTEMON	*pachyphyllus*	Wallum Bottlebrush
COMESPERMA	*defoliatum*	
LEPTOSPERMUM	*juniperinum*	
LEPTOSPERMUM	*laevigatum*	
LEPTOSPERMUM	*liversidgei*	
LEPTOSPERMUM	*semibaccatum*	
MELASTOMA	*affine*	Blue Tongue
PULTENAEA	*paleacea*	

-THESE SPECIES ARE NOT SUITABLE WITHIN TEN METRES OF DISPOSAL AREA-

TREES		
BANKSIA	*integrifolia*	
CALLISTEMON	*viminalis*	
CALLISTEMON	*salignus*	
CASUARINA	*cunninghamiana*	
CASUARINA	*glauca*	Swamp Sheoak
EUCALYPTUS	*intermedia*	Red Bloodwood
EUCALYPTUS	*microcorys*	Tallowood
EUCALYPTUS	*robusta*	Swamp Mahogany
GLOCHIDION	*ferdinandii*	Cheese Tree
LEPTOSPERMUM	*petersonii*	
LOPHOSTEMON	*suaveolens*	
MELALEUCA	*armillaris*	
MELALEUCA	*leucadendra*	
MELALEUCA	*quinquenervia*	Paperbarked Tea Tree

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Designed By:	CRC	Date:	28/01/02
Drawn By:	DAV	Scale:	AS NOTED
Checked By:	CRC	Sheet No.:	1 of 1
Job No.:	2503	Revision No.:	A

Events

At special events which will be held twice a year, it is anticipated that up to 150 people will be on site and as such portaloos will be arranged for the comfort of everyone on the property.

Viking Rentals http://www.vikingrentals.com.au/toilet-hire-weddings-events.html are a professional portable toilet hire company servicing the Greater Brisbane area. They supply dignified, stylish toilets that are appropriate for any function or special event. Their roomy toilets have a unique and highly effective ventilation system and a large sink with a foot pump.

Biolytix Waste Treatment System

The Biolytix System is a robust, organic wet soil ecosystem in a tank and is home to worms, beetles and billions of microscopic organisms. It recycles sewage and wastewater into irrigation water for the garden using minimal fossil fuels and no chemicals. It can also recycle all food scraps (with an in sink grinder) and break down non-plastic sanitary items.

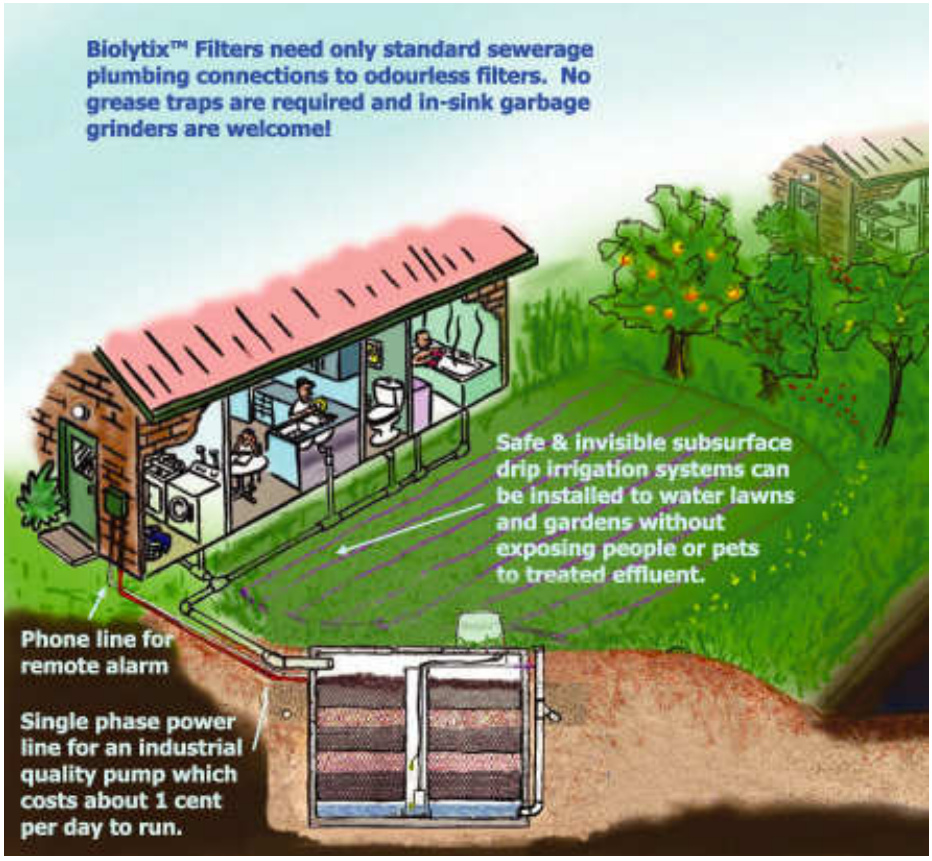
The difference between Biolytix system and other treatment systems are:

Biolytix System	Other Treatment System
1 service per year	4 services per year
Power costs less than $20 per year	Power costs more than $130 p/y
Silent operation	Uses noisy blowers
Natural process, no chemicals	Rely on chlorine
Safe for people, pets and soil	Pathogens may potentially be sprayed around
No odour	Smells after a very high loading
Small tank	Very large tanks
Continue to treat during power failure	Stop working during power failure
Handles peak and throughs in loading	Can fail after holidays or during a party
Loves organic loads such as milk down the sink	Food down the sink can lead to failure
Handles a large range of household cleaners	Often need to use strict list of cleaners
You can shower and wash when you want	Often need to spread out water usage – family planning needed
Able to enjoy to the convenience of an In-Sink-Erator for kitchen waste	Can't handle the extra load of In-Sink-Erators

Based on the anticipated number of people on the property and its weekly waste flow rate, it has been recommended that we install the Biolytix Filter Model BF6 on site.

Attached are the Biolytix waste treatment specifications and subsurface drop irrigation guidelines.

How The Biolytix® Waste Treatment System Works


Biolytix™ Filters need only standard sewerage plumbing connections to odourless filters. No grease traps are required and in-sink garbage grinders are welcome!
Safe & invisible subsurface drip irrigation systems can be installed to water lawns and gardens without exposing people or pets to treated effluent.
Phone line for remote alarm
Single phase power line for an industrial quality pump which costs about 1 cent per day to run.

The Biolytix® Filter is a robust, organic soil ecosystem that converts sewage, wastewater, sanitary items and food wastes into irrigation water.

All the wastes are simply fed onto the Biolytix® Filter bed using standard plumbing. The top layer is made up of coarse mesh bags with plastic media in them. This houses the wet soil ecosystem. It accommodates worms, beetles and billions of microscopic organisms. These soil creatures are vital "macerator" organisms, breaking up the organic material, converting the waste into humus and structuring it so that its drainage and air porosity are continually renewed and maintained indefinitely.

The organic matter particles then wash through and accumulate on the surface of a finely structured humus and coco-peat layer. Here it is reprocessed again and again and structured into a sponge-like filter by the soil organisms that live in it.

The fine structured compost has remarkable properties. It is 90% water by weight, yet has a high cation and anion exchange capacity. This means it adsorbs and holds back nutrients, chemical compounds and toxins for the trillions of living organisms to digest over time. (Competing treatment processes don't have this ability.) It also has powerful odour-absorbing capacity, which is why we can guarantee no odours.

BIOLYTIX®

Biolytix® Technologies **T** 07 54 35 2700 **F** 07 54 35 2701 **Toll Free** 1300 881 472 www.biolytix.com

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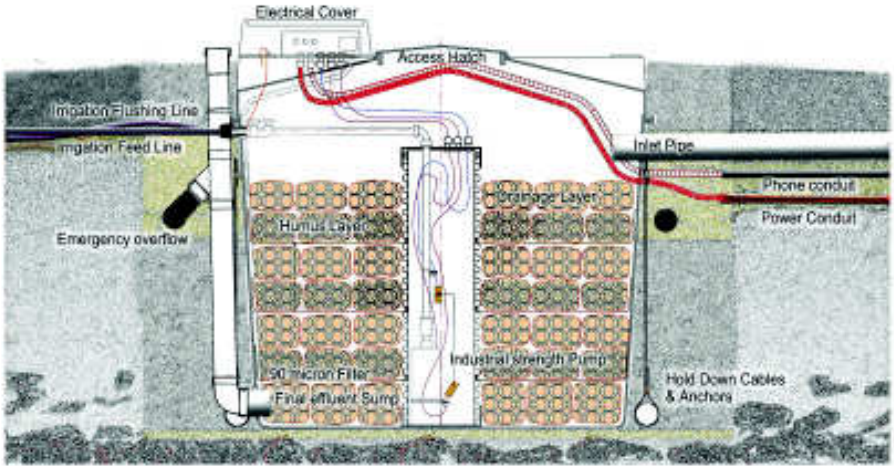
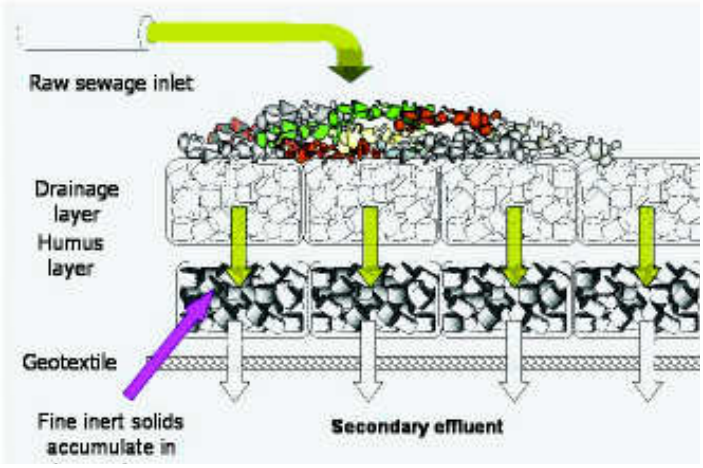
Cross Section of a typical Biolytix® Filter (BF6)



Sewage entering the top section of the Biolytix® Filter



After the last layer, the effluent has been well treated and a geofabric filter, about the diameter of the tank, filters out all particles larger than 90 micron. This three dimensional filter is biologically cleaned and does not need any maintenance. It protects the irrigation system from clogging up.

The water component of the wastewater finally accumulates in the sump where some more of the very fine sediment is settled out in a quiescent zone before the clear, reclaimed water can be pumped or drained to irrigation or reuse.

As the technology is fully aerobic it does not require an energy-intensive aquatic or odourous septic stage. The layered, flexible modular filter elements are designed to also be installed into a conventional septic tank unit, but are equally suited to be used within any vertical cylindrical tank (normally a minimum depth of approximately 1.5m is required).

Normally the filter is constructed within a standard 2500 litre polymer tank (1.88m diameter by 1.63m high). The only mechanical components in the standard treatment unit (BF6 filter) are a single-phase industrial strength pump and a tiny but robust (5 watt) air pump.

The Biolytix® Filter can be scaled according to the wastewater loading.

BIOLYTIX®

Biolytix® Technologies **T** 07 54 35 2700 **F** 07 54 35 2701 **Toll Free** 1300 881 472 www.biolytix.com

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Category	Details
Model:	**Biolytix® Filter Model BF6** (or "Deluxe Model") **Biolytix® Filter Model BF6UV (when supplied with UV disinfection)** On-site wastewater treatment system. Treats domestic wastewater to a high secondary standard.
Manufacturer:	Biolytix® Water Pty Ltd A Biolytix® Brochure "Information Kit" that provides general information on Biolytix® and the Biolytix® Filter range may be downloaded from: http://docs.biolytix.com/sales/record/SR_InfoKit%28web%29.pdf
Versions	The Filter may be configured to suit project specific requirements. Variables include: pump or gravity discharge, tank size (to suit inlet sewer invert), pump type, tank type (factory supplied or retrofit).
Bed Configuration:	Central pump well with sealed lid (pumped version only). Base level sump of bagged open plastic structural support material to a depth of approximately 300 mm. Filter bed of three layers each consisting of a geotextile support cloth under bagged structurally supported humus/peat and bagged open plastic support material to provide a total bed depth of 1050 mm (including base level sump). Refer Figure 1 for typical cross-section of Filter. A general arrangement drawing of Biolytix® BF6 Filter may be downloaded at: http://docs.biolytix.com/products/record/drawings/BF6/BF6_01.PDF

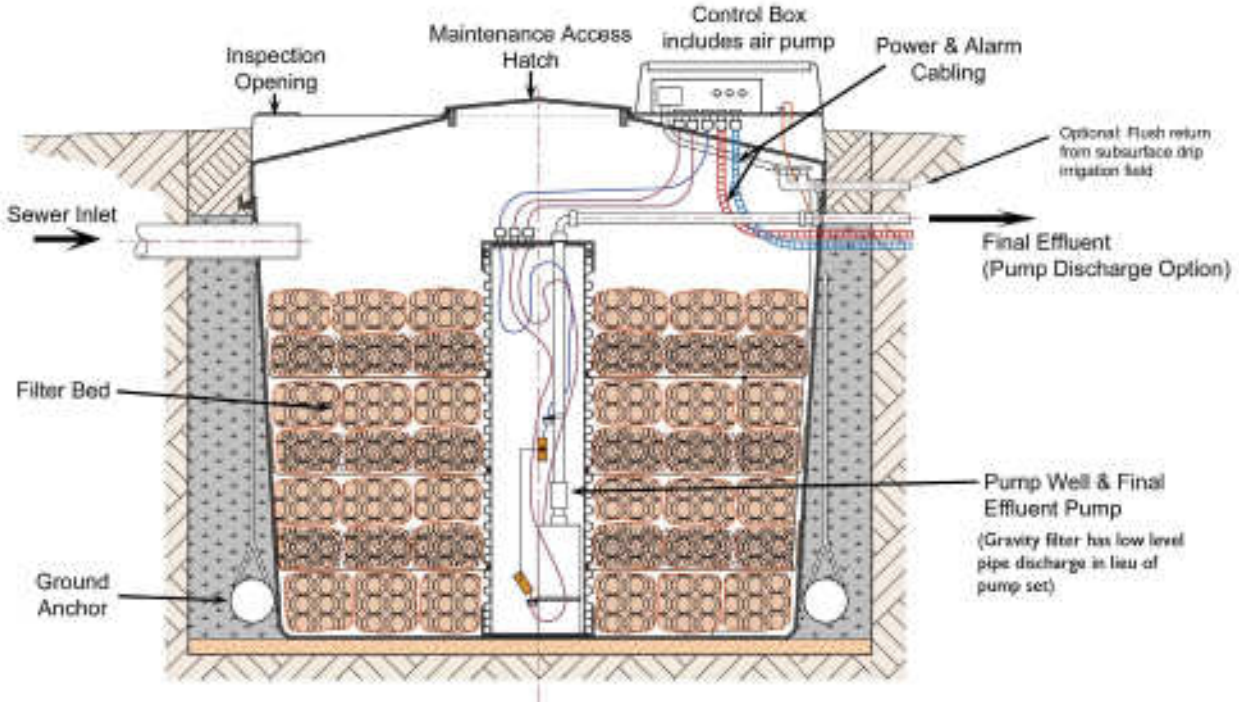
Inspection Opening
Maintenance Access Hatch
Control Box includes air pump
Power & Alarm Cabling
Optional: Flush return from subsurface drip irrigation field
Sewer Inlet
Final Effluent (Pump Discharge Option)
Filter Bed
Pump Well & Final Effluent Pump
(Gravity filter has low level pipe discharge in lieu of pump set)
Ground Anchor

Figure 1: Cross Section of Biolytix® Filter BF6 (Pumped Discharge Version)

CRICOS No. 00213J

Category	Details
Certification:	Regulatory approval requirements for installation of a Biolytix® BF6 and BF6UV vary throughout Australia and New Zealand. This section summarises general accreditation approvals for each state or region. Pumped version passed independent testing (SAI Global) to AS/NZS 1546.3 for alternative aerated treatment systems, including operational options: 1. UV disinfection at a dose rate of 88 mWs/cm^2 2. Influent loaded with 2.4 kg/day of putrescible food waste passed through an in-sink food waste disposal unit. Gravity Filter has same bed configuration as pumped systems. Copies of SAI Global reports (include effluent quality data) for two separate testing trials and StandardsMark Certificate may be obtained from: http://docs.biolytix.com/products/record/PR_BF6ApprovalWithUV.pdf (covers filter with/without UV disinfection) http://docs.biolytix.com/products/record/PR_BF6JASANZReport.pdf http://docs.biolytix.com/products/record/BF6_JASANZ_ReportUV.pdf
	Filter Operation Approvals – BF6 Filter with no disinfection **Approval Authority & Reference/ webpage link to document copy**
Australia	
NT	Dept of Health & Community Services: Approval Number 08/07 http://docs.biolytix.com/products/record/PR_BF6ApprovalForNT.pdf
NSW	Dept. of Health: WCT 023 http://docs.biolytix.com/products/record/PR_BF6ApprovalForNSW.pdf
QLD	Dept. of Infrastructure & Planning: Chief Executive Approval No. 04/2007 http://docs.biolytix.com/products/record/PR_BF6ApprovalForQld.pdf
SA	Dept. of Human Services: WCS 01586, 16/12/2003 http://docs.biolytix.com/products/record/PR_BF6ApprovalForSA.pdf
Tas	Dept. of Justice: Accreditation BSR 0438/2006 http://docs.biolytix.com/products/record/PR_BF6ApprovalForTAS.pdf
Vic	EPA Victoria:CA90/04 http://docs.biolytix.com/products/record/PR_BF6ApprovalForVic.pdf
WA	WA Health: Approval No 169 http://docs.biolytix.com/products/record/PR_BF6ApprovalForWA.pdf
New Zealand	
ARC	ARC letter 13 April 2006. http://docs.biolytix.com/products/record/PR_BF6ApprovalARC.pdf
	Filter Operation Approvals – BF6 Filter with UV Disinfection (BF6UV)
Australia	
NT	Project specific approval by NT Dept. of Health required.
NSW	Dept. of Health: BF-002 http://docs.biolytix.com/products/record/PR_BF6ApprovalForNSW.pdf
QLD	Dept. of Infrastructure & Planning: Chief Executive Approval No. 04/2007 http://docs.biolytix.com/products/record/PR_BF6ApprovalForQld.pdf
SA	Dept. of Health: WCS 02077 13/4/2006 http://docs.biolytix.com/products/record/PR_BF6ApprovalForSA.pdf
Tas	Application pending
Vic	Project specific approval by Council required. Supplementary fittings or attachments (e.g. UV disinfection) to certified systems do not require EPA approval.
WA	Application pending
New Zealand	
	No formal approvals in place. Contact regulatory authority for requirements.

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<table>
<tr><th>Category</th><th>Details</th></tr>
<tr><td>Effluent quality:</td><td>Secondary standard effluent quality as defined by AS/NZS1547 – “Effluent quality following secondary treatment is expected to be equal or better than 20 g/m^3 5-day biochemical oxygen demand and 30 g/m^3 suspended solids”.
Effluent quality produced by the BF6 Filter is to a higher standard than the secondary standard effluent quality limits. SAI Global completed independent performance tests to AS/NZS1546.3 On-site Domestic Wastewater Treatment Units Part 3: Aerated Wastewater Treatment Systems September 2003. The Table below summarises the results from the independent testing on the BF6 Filter. Essentially the independent testing showed that the Biolytix® Filter (BF6) produces a high quality secondary effluent.
No detailed mass balance has been carried out on the nutrient removal efficiency of the Biolytix® BF6 Filter. Based on independent test results from Environment Bay of Plenty on the BF6 Filter module, the average nutrient levels in the final effluent were typically TN: 42mg/L (NH_3 approx 30%, NO_x approx 70%) and TP 8mg/L. Nutrient levels may however vary significantly subject to hydraulic load and the nutrient level in the influent wastewater (e.g. strength of influent and whether insinkerator is installed). Greater N removal is normally achieved at higher hydraulic loading rates.
BF6 Filter Effluent Quality
90 percentile data from AS1546.3 independent tests
<table>
<tr><th></th><th>Standard</th><th>Putrescible food waste</th></tr>
<tr><td>Biochemical Oxygen Demand -BOD_5</td><td>≤ 12 mg/L</td><td>≤ 15 mg/L</td></tr>
<tr><td>Total suspended solids</td><td>≤ 9 mg/L</td><td>≤ 10 mg/L</td></tr>
<tr><td>Thermotolerant Coliforms</td><td><10 cfu/100mL*</td><td>< 10 cfu/100mL*</td></tr>
</table>
*Thermotolerant Coliforms only applicable with UV disinfection. The Biolytix® Filter normally achieves 3-4 log reduction in Thermotolerant Coliforms without separate disinfection equipment.</td></tr>
<tr><td>On-site dispersal:</td><td>Dispersal is to be in accordance with regulatory requirements, typical requirements are as follows:
Subsurface drip irrigation or trenches/beds/mounds installed to AS/NZS 1547 if effluent is not disinfected with UV. Biolytix® supplies IWT Netafim Safety Flow dripline and irrigation equipment (refer www.kisss.net.au) as standard option for subsurface and subsoil irrigation. Subsurface drip irrigation guidelines document may be downloaded from: http://docs.biolytix.com/products/procedure/PP_BiolytixDripIrrigationGuidelines.pdf
Surface or subsurface irrigation installed to AS/NZS 1547 with UV disinfection at a dose rate not less than 88 mWs/cm^2.</td></tr>
<tr><td>Loading:</td><td>Hydraulic:
Standard Filter bed – Filter bed volume 1.6m^3
Long Term Acceptance Rate (LTAR) 1600 L/day (10 person per day equivalent).
4-day peak capacity 2150 L/day
Concrete or Non-standard tank – Requires 1 m^3 of bed volume per kilolitre of influent per day or 660 mm/day internal surface, whichever is the lesser. Peak loading rate is 880 mm internal surface area/day.
Biological:
The maximum allowable BOD loading for the Filter varies slightly with certification conditions (refer section “Certification”). The Filter has been comprehensively tested to treat domestic wastewater including putrescible food wastes (through Insinkerator) at the maximum hydraulic loading rates specified above (i.e. 10 person loading). Based on normally accepted BOD loading figures of 60 g.BOD/person per day and putrescible waste (garbage disposal) increasing organic loading by 33%, the Biolytix® Filter has a daily BOD capacity of at least 800 g.BOD/day.
Contact Biolytix® if the Filter is required to treat non-standard wastewater (e.g. blackwater only) as the hydraulic loading maximum may need to be reduced to suit higher strength wastewater.</td></tr>
</table>

Tank Details:

Standard Tanks & Existing Tank Retrofit Kits

Standard:
The standard Biolytix® Filter is installed in an Everhard polymer septic tank (refer www.everhard.com.au). The Filter may also be supplied in other tanks (e.g. concrete) certified to AS/NZS 1546.1 .

Everhard Tank (size)		**3000**	**4000**[1]
Height (m):	excl. control box	1.90	2.36
	incl. control box	2.06	2.51
Diameter (m):		1.88	1.88
Inlet Sewer Invert Depth (m)		0.65	1.1
Mass:	Dry (kg)	396	440
	Wet[2] (kg)	970	1014

1. The 4000 size Filters have the same bed configuration as the 3000 Filter except that the tank is deeper and therefore the bed is located deeper in the ground.
2. Wet weight is with moist filter media, but with no standing water in Filter sump. Filters would normally be delivered with dry weight.

Retrofit: The Biolytix® Filter bed may be retrofitted into an existing Australian Standard compliant septic. Typically the tank should be vertical cylindrical with a central access hatch, although it may be possible to retrofit into other tank shapes. Biolytix® provides retrofit kits for various circular tank diameters. A minimum 1.6 m diameter tank is required, and a minimum of 1.1m tank depth is required below inlet sewer to provide sufficient depth for installation of Filter bed.

Level Control:

Treated effluent either discharges under gravity or is pumped. In pumped option, effluent is stored in the base layer of each Filter module until float controls are initiated.
Standard float switch with swivel mount
Open circuit typical setting: 60mm represents 120 l left in storage
Closed circuit typical setting: 170mm 340 l in storage

Alarm:

Various options are available including:

Standard Telemetry: Event Monita (or equivalent) phone line telemetry alarm direct to service provider. Operates on any analogue/ digital telephone system and is certified for operation with the ACA on the Australian Telephone Network.

Audio/ Visual: Standard AS 1546.3 compliant audible and visual alarm. Different options are available, including siren or panel mount systems.

Electrical control box:

IP56 polycarbonate weatherproof control box and isolation switch.
All components to AS3000:2000.

Control box is normally mounted on BF6 Filter module as standard. Wall/ post mount control box option is also available (e.g. for areas that may be prone to flooding).

Pump cycle:

Adjustable range 160-220 litres.

Pump specifications:

(Pump discharge Filter only)

Biolytix® normally supplies Pedrollo Pumps in the Sumo and Top ranges. Full specification details of Pedrollo pumps may be obtained from: www.pedrollo.com. The standard pump supplied is a Pedrollo Sumo 2/5, however a Pedrollo Sumo 2/7 or other suitable borehole type pump may be installed to suit required duty.

General specification details of the standard pumps supplied, is summarised in table below.

Manufacturer:	Pedrollo Spa			
Model:	Top 2	Top 3	Sumo 2/5 (BF6 default)	Sumo 2/7
Voltage/Phase:	240 volts AC/ Single			
Thermal protection:	Yes			
Seals:	Double oil lubricated mechanical			
Submersion (max)	6m		20m	
Head (max)	9m	10.5m	36m	60m
Duty 1	20l/min@8m	20l/min@10m	10l/min@35m	10l/min@58m
Duty 2	140l/min@4m	200l/min @ 4m	80 l/min @14m	80 l/min @ 18m
Power:	0.37kW	0.50kW	0.45kW	0.75kW
Estimated life:	3,000 hours		10,000 hours	

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Air Pump Specifications	**Manufacturer:**	Schego
	Model:	M2K3 (membrane pump)
	Voltage/phase/power:	220-240 V/50Hz/single 5 watt
	Maximum delivery head:	3m
	Flow rate:	350 l/hr
	Estimated life:	Diaphragm = 4 years/ Coil = 20 years
	Refer Schego website for further details: http://www.schego.de	
UV Disinfection Unit (Optional)	UV disinfection unit needs to be ordered separately to the Biolytix® Filter.	
	Models:	Various, selected to provide a minimum dose rate of 88mWs/cm^2 at the design flow rate for the land application system.
	Chamber Material:	316SS
	Peak Flow (BF6 effluent):	Selected to suit UV dose.
	UV Lamp Wattage:	75 Watt minimum at 12L/min.
	UV Rated Lamp Life	Selected at 9000 hrs minimum (1 year)
	Voltage:	220/240 VAC, 50Hz
	Protection Class:	IP21
	Installation	Mounted in accordance with manufacturer's installation instructions, either on top of Biolytix® Filter or remote from Filter, subject to site requirements.
Energy Usage	*Treatment Process*: Air Pump. Air pump operates continuously (5 watts), using 0.120 kWhr/day. A Filter operating at a full capacity (1600 L/day) would have an energy usage of 0.075 kWhrs/kL treated. *Final Effluent Discharge*: BF6 Transfer Pump (pump units only). Energy use for a pumped BF6 Filter varies with pump selection, hydraulic load and discharge pipework design. A Filter fitted with a Sumo 2/5 pump discharging to subsurface drip irrigation will typically have an energy usage in the range 0.3-0.8 kWhrs/kL treated. A gravity discharge BF6 Filter requires no additional energy.	
Maximum Noise	Complies with AS 1546.1 < 40 dB(A) @1m fast response	
Operating conditions:	Operates under normal temperature and humidity conditions experienced in Australia and New Zealand (if winter temperatures regularly drop below – 8°C then site ground temperature, soil conditions and hydrology assessment is required to determine if thermal ground insulation is warranted). A cold climate add-on kit is currently under development to enhance performance of treatment system in cold climate regions (e.g. in Tasmania defined as above 900m AHD)	
Emergency storage capacity:	1,340 litres above high level float cut-in level and below the top filter layer (maintains a dry refuge for filter organisms to survive). If flooding exceeds this level, the filter bed may need re-inoculation. The emergency storage typically allows a response time of more than 2 days at a typical domestic household loading rate of 600 L/day.	
Installation	The Biolytix® Filter modules are designed typically for in-ground installation. If the Filter is to be installed above ground, the external walls of the tank are to be UV protected. A detailed copy of the Biolytix® Filter installation manuals may be downloaded from: http://docs.biolytix.com/installation/procedure/IP_BiolytixFilterInstallationManual.pdf Electrical Installation manual: http://docs.biolytix.com/installation/procedure/IP_ElectricalInstallationProcedure.pdf Telemetry Connection manual: http://docs.biolytix.com/installation/procedure/IP_TelemetryConnectionManual.pdf Retrofit kits are to be installed by a trained Biolytix® Installer.	

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<table>
<tr><td>Servicing Requirements:</td><td>Servicing procedures are detailed in the Biolytix® Instruction & Service Manual. A copy of the manual may be downloaded from:
http://docs.biolytix.com/service/procedure/VP_BiolytixServiceManual.pdf
The Biolytix® Filters require an annual service and system check that includes:
Monitoring and maintenance of humus levels;
Testing effluent quality compliance;
Integrity check for pump, switches, alarm;
Checking biology of the Filter bed;
Flushing irrigation lines and irrigation filter;
Reporting on system performance.
UV Lamp (if installed)
Quartz sleeve cleaned 6-monthly.
UV lamp replaced every 12 months.</td></tr>
<tr><td>Operators Manual</td><td>A copy of the operator’s manual may be downloaded from:
http://docs.biolytix.com/service/record/VR_OperatorsManual.pdf</td></tr>
<tr><td>Warranty:</td><td>A 12-month warranty is provided free of charge with the purchase of a Biolytix® Filter, guaranteeing the performance, and all components for that period. The Biolytix® Performance Warranty for the Biolytix® Filter is also available after that period for up to 20 years consecutively. Annual fees apply depending on the Filter model, and this includes the above-mentioned annual service. The serviceable life of the treatment system is equal to the tank life – typically 20+ years.
A copy of Biolytix® Performance Warranty may be downloaded from:
http://docs.biolytix.com/service/form/VF_PerformanceWarranty.pdf</td></tr>
<tr><td>Product Specification / Naming Convention Details</td><td>The table below provides a simplified outline of the Filter naming convention that covers the most popular Filter range. Biolytix® Filter Naming Convention Document (PP-FilterNamingConvention) should be referenced to specify special filter configurations (e.g. with a pump different to a Sumo 2/5 or to be supplied as a retrofit kit).
<table>
<tr><th>Model</th><th>Tank Size</th><th>Pump/ Gravity Discharge</th><th>Air Pump</th><th>Telemetry or Audio Visual Alarm</th></tr>
<tr><td>BF6*</td><td>3000</td><td>P</td><td>A</td><td>T</td></tr>
<tr><td></td><td>4000</td><td>G</td><td></td><td>V</td></tr>
</table>
* When filter is supplied with UV disinfection the model is denoted as BF6UV.
Examples:
BF6-3000-PAT: BF6 Filter with 3000 litre Everhard tank, Sumo 2/5 pump discharge, Schego air pump and phone line telemetry alarm.
BF6UV-3000-PAT: BF6 Filter with UV disinfection, 3000 litre Everhard tank, Sumo 2/5 pump discharge, Schego air pump and phone line telemetry alarm.
BF6-4000-GAV: BF6 Filter with 4000 litre Everhard tank, gravity discharge, Schego air pump and audio visual alarm system.
BF6-4000-PAT: BF6 Filter with 4000 litre Everhard tank, Sumo 2/5 pump discharge, Schego air pump and phone line telemetry alarm system.
BF6-4000-PAV: BF6 Filter with 4000 litre Everhard tank, Sumo 2/5 pump discharge, Schego air pump and audio visual alarm system.</td></tr>
</table>

Biolytix Technologies

SUBSURFACE DRIP IRRIGATION

Biolytix Filter (Bf6)

July 2005

CRICOS No. 00213J

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Document Status

Rev	Status	Author	Reviewer		Approved for Issue		
			Name	Signature	Name	Signature	Date
A	First Issue	GRI	D Cameron		J Jordan		11/6/04
B	Second Issue	GRI	D Cameron		J Jordan		29/6/04
C	IWT dripline option	GRI	D Cameron		J Jordan		3/6/05

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1. INTRODUCTION

1.1. General

The Biolytix Filter – BF6 produces a wastewater effluent quality suitable for direct subsurface drip irrigation. This document provides general information to assist with the design and installation of a subsurface drip irrigation system suitable for use with a Biolytix Filter – BF6, pumped version (i.e. BF6-PAT or BF6PAV).

Biolytix provides irrigation kits using Irrigation and Water Technologies (IWT) patented Safety Flow Irrigation dripline and this manual is based on the use of this dripline. Alternative driplines may require a different design approach. The Safety Flow dripline utilizes Netafim Uniram pressure compensating dripline and references and extracts are taken from Netafim and IWT design guides and specifications wherever possible.

1.2. Biolytix Filter

Two parameters of the Biolytix Filter, BF6 affect the operation of a subsurface drip irrigation system, the pumping system and effluent quality. These parameters are discussed below.

1.2.1. Effluent Quality

Australian Standard, AS/NZS 1547:2000: On site domestic-wastewater management includes design and construction details for an on-site subsurface drip irrigation system. AS1547 recommends optimum performance may be obtained from a subsurface drip irrigation system if high quality secondary treated effluent having BOD_5 (5-day Biochemical Oxygen Demand) and SS (Suspended Solids) levels of 15/15 mg/L. Table 1 summarises the effluent characteristics of the Biolytix Filter BF6 that were achieved when the filter was independently tested by SAI Global to AS/NZS 1546.3:2001. The test results confirm that the Biolytix Filter produces an effluent quality ideal for subsurface drip irrigation.

Table 1: Effluent Characteristics from BF6 Filter

Characteristic	Results	Maximum	Average
BOD_5	100% < 20 mg/L 90% < 11.6 mg/L	14 mg/L	8.7 mg/L
Suspended Solids	All < 30mg/L 90% < 8.9 mg/L	14 mg/L	5.4 mg/L

1.2.2. Pumping System

Treated effluent is stored at the base of the Biolytix™ Filter. The Biolytix™ Filter contains a multistage submersible pump capable of pumping 10L/min at 35 metres and 75 L/min at 15m. A copy of the pump system curve is contained in Appendix A (may be used to design an irrigation system from first principles). The pump operates automatically by float switch when the stored volume reaches approximately 340 litres and stops when the storage is depleted to approximately 120 litres. The effective 220 litre storage volume complies with AS1547 recommendations of 200 litres minimum storage for a drip irrigation pump system.

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The BF6 filter pump is ideally suited for direct sub-surface irrigation (pulsed drip). Pulsed subsurface drip irrigation is effective at removing nutrients as well as bacterial and viral pathogens so disinfection of the effluent or nutrient removal prior to irrigation should not normally be necessary.

1.3. Safety Flow Dripline

Safety Flow Dripline was invented by Australian company, IWT. Safety Flow is a subsurface drip irrigation system that uses a geotextile to spread the water in both a horizontal and lateral wetting pattern. In one configuration it uses an impermeable layer of polyethylene to minimise the movement of water downwards by gravity allowing the soil to make full use of the water in capillary action. It has a drip line (Netafim) delivering the water to the geotextile, and the base polyethylene layer, at a consistent and predetermined rate. The flow rates and emitter spacing can be adjusted to soil conditions and length of run. The dripline creates an elliptical wetting pattern along the whole length of the material. A Safety Flow product specification is included in Appendix B.

Safety Flow is the first sub surface irrigation system, which uses precision capillary irrigation to better manage:

- Gravitational water loss by using steady state irrigation technology.
- Saline soil conditions by displacing and diluting salts through precise applications of fresh water.
- Root zone wetting patterns by only irrigating to replace daily evaporative losses or as the plant demands.
- Daily irrigation requirements directly against evaporative losses and plant requirements without overloading soils to saturation point constantly.
- Emitter blockages by roots through a protective geofabric layer around the drip lines with impregnated copper based root inhibitor.
- Rodent and insect “strikes” and mechanical damage because the system can be deeper than competitors and has protective materials around the drip lines.
- Use of treated effluent as irrigation water by ensuring an even distribution into the capillary spaces of the soil rather than the macro-pore spaces without contamination to the surface or deep percolation into ground water.
- Contaminated sites by irrigating without spreading the contaminant, allowing deep percolation of the contaminant or bringing it to the surface.
- Water wastage by using low flow emission rates combined with geotextile that use capillary and mass flow to discharge water evenly without fluidising the soil and destroying soil structure
- Yield increase, quality and predetermined growth rates by applying water to the roots at the precise time and location needed.

The Netafim Uniram dripline contained within the Safety Flow wrap is a pressure compensated continuous self-cleaning drip-line.

The Uniram drip-line has the following features:

- The pressure compensating range is 10-35m.
- Unique non-leakage mechanism (CNL) which eliminates drainage and refill effect (requires a minimum 10m operating head to open).
- High clogging resistance with unique self-flushing mechanism.
- The silicon diaphragm in the dripper is chlorine resistant.

- Unique anti-vacuum mechanism preventing sucking of soil into the dripline.

2. DESIGN

2.1. General Concept

Figure 1 details a typical single zone subsurface drip irrigation layout. The Biolytix™ Filter pump is connected to an irrigation distribution pipe that feed a number of dripline lateral pipes. Pressure compensating, non leak driplines (e.g. Safe T Flow) are normally recommended as they enable the dripline to be installed on sloping sites without requiring additional pressure valve controls. The dripline is typically installed perpendicular to (across) slopes.

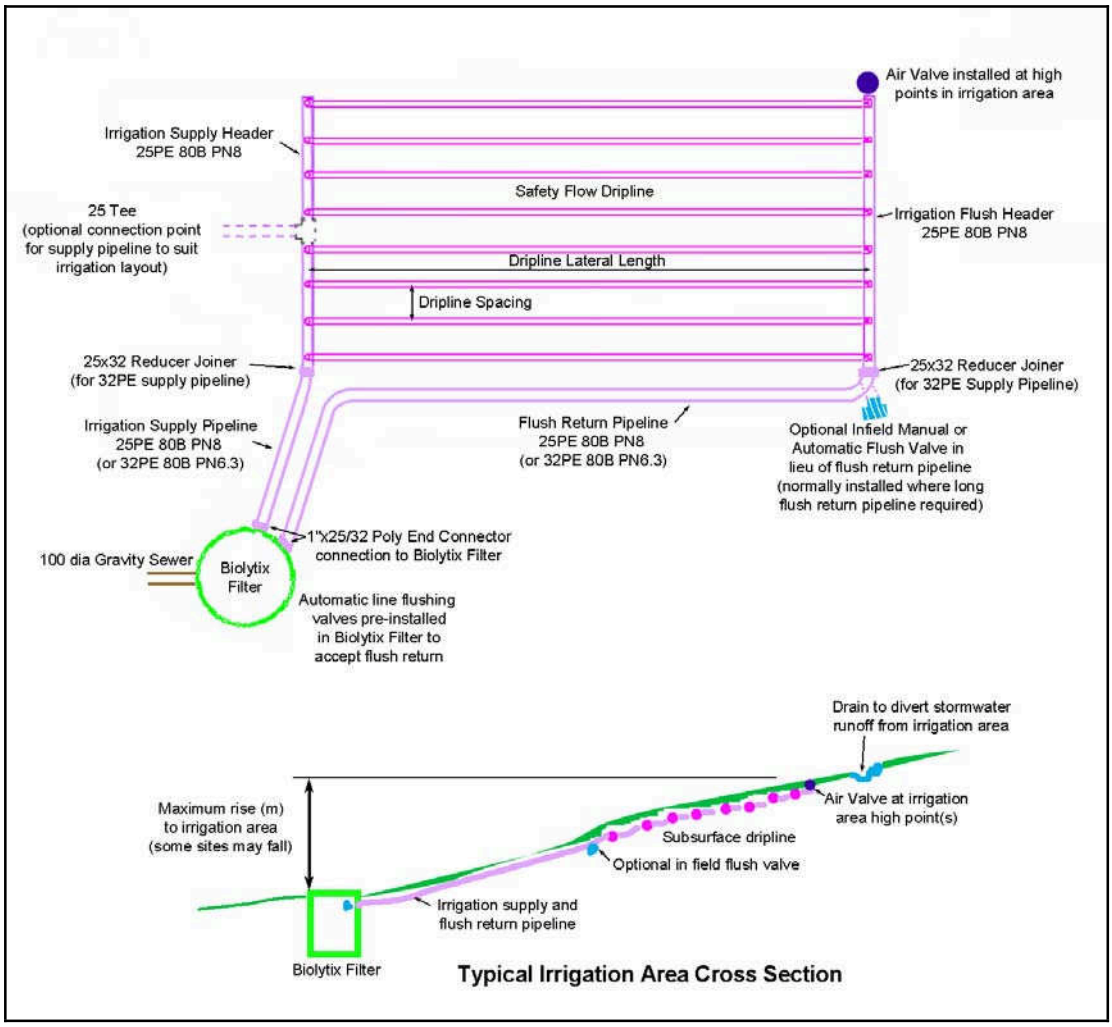

Air Valve installed at high points in irrigation area
Irrigation Supply Header 25PE 80B PN8
Safety Flow Dripline
25 Tee (optional connection point for supply pipeline to suit irrigation layout)
Irrigation Flush Header 25PE 80B PN8
Dripline Lateral Length
Dripline Spacing
25x32 Reducer Joiner (for 32PE supply pipeline)
25x32 Reducer Joiner (for 32PE Supply Pipeline)
Irrigation Supply Pipeline 25PE 80B PN8 (or 32PE 80B PN6.3)
Flush Return Pipeline 25PE 80B PN8 (or 32PE 80B PN6.3)
Optional Infield Manual or Automatic Flush Valve in lieu of flush return pipeline (normally installed where long flush return pipeline required)
100 dia Gravity Sewer
Biolytix Filter
1"x25/32 Poly End Connector connection to Biolytix Filter
Automatic line flushing valves pre-installed in Biolytix Filter to accept flush return
Drain to divert stormwater runoff from irrigation area
Maximum rise (m) to irrigation area (some sites may fall)
Air Valve at irrigation area high point(s)
Subsurface dripline
Optional in field flush valve
Irrigation supply and flush return pipeline
Biolytix Filter
Typical Irrigation Area Cross Section

Figure 1: Biolytix Filter – Subsurface Irrigation Schematic

The end of each irrigation lateral is connected to a flush header or manifold that returns either to the Biolytix filter (typical) or alternatively to an infield flush valve. Automatic flush valve(s) are installed in each Biolytix Filter ready to accept the flush return pipeline. The infield flush valve alternative would normally only be considered when a long flush return pipeline would be required (e.g. say greater than 50m). The automatic flush valve(s) operate at the commencement of each pumping cycle to provide a short term "flush" velocity within the dripline. The flush valves may be

removed (by maintenance personnel) to enable a “flush” velocity to be maintained for an extended period during dripline maintenance.

Air valves are required to be installed at all high points within the dripline system to prevent soil suction into the driplines (due to back pressure or back siphoning) and to release air from the pipeline during filling and allow air into the pipeline during draining. If all pipework can be graded to one high point only one air valve would be required. On most sites this may be difficult to achieve and as a minimum an air valve is likely to be required on each of the distribution and flush pipelines. Additional air valves may be necessary on individual drip line lengths at localized high points.

Normally subsurface drip irrigation areas require an inline filter to be installed after the pumping system. No filter is necessary as the Biolytix Filter provides filtration to a higher standard than a 150-200 mesh.

On sloping sites the top of the irrigation area is to be graded to prevent stormwater runoff into the irrigation area.

Figure 2 provides examples of possible drip irrigation layouts. The preferred layout will need to be selected to suit project specific requirements.

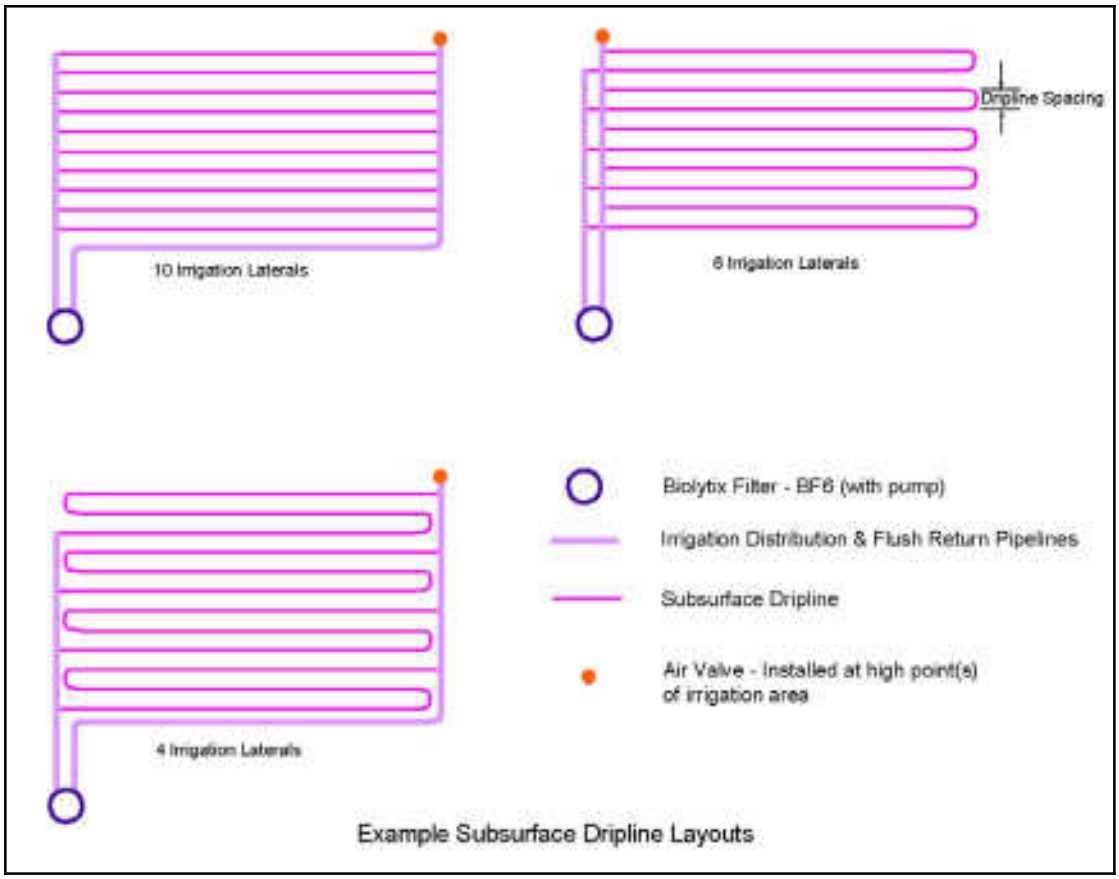

10 Irrigation Laterals
Dripline Spacing
6 Irrigation Laterals
4 Irrigation Laterals
Biolytix Filter - BF6 (with pump)
Irrigation Distribution & Flush Return Pipelines
Subsurface Dripline
Air Valve - Installed at high point(s) of irrigation area
Example Subsurface Dripline Layouts

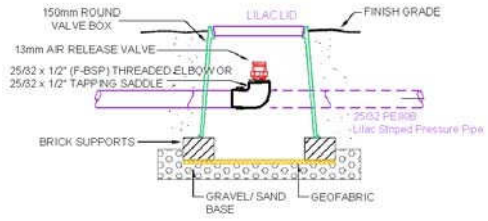
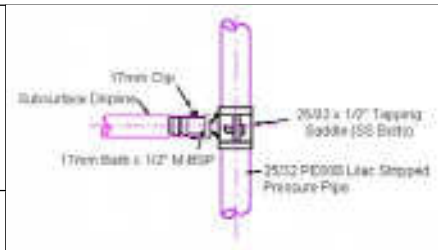
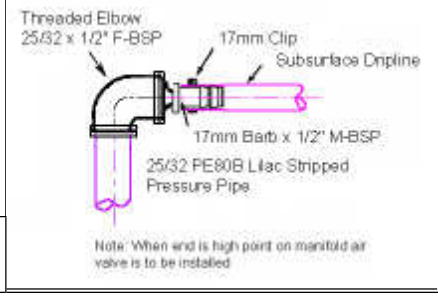
Figure 2: Subsurface Dripline Example Layouts

2.2. System Components

Biolytix supply irrigation kits that cover a range of irrigation areas that are normally encountered to dispose of on-site effluent. Additional components are also supplied to complement the standard kits to cover sites that have special design requirements.

Complete details of the irrigation kits are contained in Appendix B. Table 2 summarises the key components of the drip irrigation kits and their application.

Table 2 Irrigation Kit Components

Component	Details
Irrigation Supply Pipeline	Transfers treated effluent from the Biolytix™ Filter to the irrigation supply header. Polyethylene pipe is supplied with lilac stripes (denotes treated effluent pipeline in accordance with Australian Standards). 25mm PE pipeline is normally adequate for most applications. Sites that have a long distribution pipe length or have large irrigation areas may require a larger diameter pipeline.
Supply and flush header	Standard irrigation kits supply 25 PE80B PN6.3 lilac striped pipeline. On most projects a larger diameter pipeline should not be necessary for header pipework.
Dripline	IWT Safety Flow Dripline with pressure compensating emitters is supplied in the irrigation kits. These driplines are provided with dripline rates of 2.67, 3.83 and 7.00 litres/metre/hour. Refer Appendix B for specification details.
Flush Pipeline	PE pipeline is supplied similar to the distribution pipeline. The flush pipeline is provided to allow periodic flushing (cleaning) of the dripline laterals. Flush flows are normally returned to the Biolytix™ Filter.
Air Valves	Installed at high points in the irrigation pipework to prevent dripline emitters from sucking soil back into dripline due to back siphoning (may occur at completion of each pump cycle when dripline drains under gravity). Standard irrigation kits contain 1 air valve kit. Additional kits may be ordered  150mm ROUND VALVE BOX LILAC LID FINISH GRADE 13mm AIR RELEASE VALVE 25/32 x 1/2" (F-BSP) THREADED ELBOW OR 25/32 x 1/2" TAPPING SADDLE BRICK SUPPORTS GRAVEL/ SAND BASE GEOFABRIC
Tapping Saddles	Connect directly on flush and distribution pipeline to allow connection of air valves and irrigation pipe fittings. Tapping saddles are supplied with stainless steel bolts. 
Irrigation pipe fittings	Directors (13mm tail x ½" male BSP): allow dripline to be connected to distribution and flush pipelines (via tapping saddles). Joiners: nominal amount supplied to join dripline sections (may also be necessary to repair damaged pipe sections). Rachet clips: Clamp dripline to directors and joiners  Threaded Elbow 25/32 x 1/2" F-BSP 17mm Clip Subsurface Dripline 17mm Barb x 1/2" M-BSP 25/32 PE80B Lilac Stripped Pressure Pipe Note: When end is high point on manifold air valve is to be installed
PE Pipe fittings	Miscellaneous PE pipe fittings are supplied to facilitate installation.

2.3. AS1547 Design Guide

AS1547 includes general details on design and construction of requirements for a subsurface drip irrigation scheme. Appendix F provides a form to assist with the design of a subsurface drip irrigation scheme that includes appropriate design references to AS1547. Appendix E summarises Biolytix methods and procedures that differ to AS1547.

3. CONSTRUCTION DETAILS

Details to assist the construction of a subsurface drip irrigation system are contained in Appendix J.

4. REFERENCES

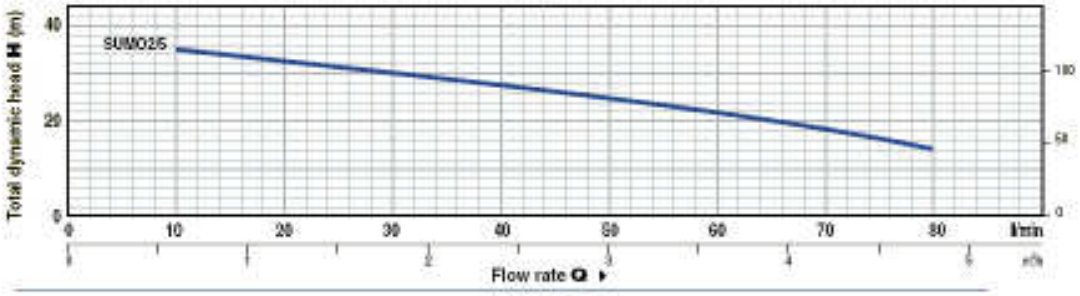
Netafim Techline Design Guide; Subsurface or On-surface Pressure Compensating Dripperline; Netafim.

Irrigation Water Technologies Pty Ltd Safety Flow Specification.

Design Guideline for Netafim Wastewater Dispersal System (Domestic Use); Netafim Australian Pty Ltd

Appendix A. Biolytix Filter Pump System Curve

The Biolytix Filter BF6 has a Sumo m2/5 pump installed (refer pump system curve below). Curve may be used to design irrigation system from first principles.



PERFORMANCE DATA AT n= 2900 1/min

PUMP MODEL	POWER		Q m^3/h	0	0.6	1.2	1.8	2.4	2.7	3	3.3	3.6	3.9	4.2	4.5	4.8
Single phase	kW	HP	l/min	0	10	20	30	40	45	50	55	60	65	70	75	80
SUMOm 2/5	0.45	0.6		36	35	33	31	28	26	25	23	22	20	18	16	14

Appendix B. Safety Flow Specification

<table>
<tr><td rowspan="2"> </td><td colspan="3">Safety Flow</td></tr>
<tr><td>SFW 266</td><td>SFW 382</td><td>SFW 700</td></tr>
<tr><td>Flow rate/m</td><td>2.6 litre/metre/hour</td><td>3.8 litre/metre/hour</td><td>7.0 litre/metre/hour</td></tr>
<tr><td>Irrigation pipe</td><td colspan="3">Netafim Uniram 17cnl- Pressure Compensated-Non-Leak</td></tr>
<tr><td>Opening Pressure</td><td colspan="3">10 m head (Eliminates drainage and refill effect)</td></tr>
<tr><td>Pressure Max. Limit</td><td colspan="3">35 m head</td></tr>
<tr><td>Dripper line ID</td><td colspan="3">14.4 mm</td></tr>
<tr><td>Dripper Line OD</td><td colspan="3">16.4 mm</td></tr>
<tr><td>KD</td><td colspan="3">1.2</td></tr>
<tr><td>Geotextile Wrapping</td><td colspan="3">Polyester. The geotextile has very good longevity being polyester, which does not break down in soils unless they are highly acidic to a pH of 2-3 over a long period of exposure. The polyester threads repel the water along the lines to fill all pore spaces and transfer the water 3,000 times faster than a clay loam as tested by Charles Sturt University 1996.
Soil colloids can fill the pore spaces but this will still allow the transfer of water and nutrients between the colloids and the fibre.</td></tr>
<tr><td>Top Layer</td><td colspan="3">18mm polyethylene film</td></tr>
<tr><td>Root control</td><td colspan="3">Geotextile is copper treated. This has the following benefits:
• Inhibits root intrusion into the geotextile or the dripper
• No bacterial build up around the outside of the dripper in the soil
• No leaching of copper as it is enclosed in the threads of the geotextile.</td></tr>
<tr><td>Depth and Spacing</td><td colspan="3">The Safety Flow system has demonstrated wetting patterns of 1.2m wide in sandy loam soils at the University of Western Sydney, Richmond, over 3 years of trials. In loams or loamy clays the wetting pattern can reach up to 2 meters wide over a period of time especially where the irrigation delivery is daily as in waste water. The wetting front has a pulsing effect which pushes the vector pattern wide until the soil colloids cannot sustain the amount of water to evaporation or gravitational forces.
The following is IWT recommendation for depth and spacing for waste water dispersion based on research outcomes from the CSIRO Land and Water, Griffith, University of Western Sydney, Richmond and the University of Queensland, Gatton.1995-2003 (i.e. maximises wetting).</td></tr>
<tr><td></td><td>Soil Texture</td><td>Depth</td><td>Spacing</td></tr>
<tr><td></td><td>Sand</td><td>200mm</td><td>1.5m</td></tr>
<tr><td></td><td>Loam</td><td>300mm</td><td>1.5-2m</td></tr>
<tr><td></td><td>Sandy Loam</td><td>250-300mm</td><td>1.2-1.5</td></tr>
<tr><td></td><td>Clay loam</td><td>300mm</td><td>1.5-2m</td></tr>
<tr><td></td><td colspan="3">The Safety Flow may be installed at 100/150mm cover (as per AS1547) however a closer spacing of Safety Flow would be required in this instance . Safety Flow can also be installed up to depths of 300mm in most soil textures</td></tr>
<tr><td>Maintenance requirements</td><td colspan="3">Flush lines every 6-12 months</td></tr>
<tr><td>Installation methods</td><td colspan="3">IWT Implement/Trenching machine or manually</td></tr>
<tr><td>Connection fittings</td><td colspan="3">Uniram (Netafim 17mm dripline industry standard)</td></tr>
<tr><td>Coil Length</td><td colspan="3">100 m</td></tr>
<tr><td>Warranty</td><td colspan="3">15 years on manufacturing and materials if installed and maintained as per guidelines set out by the manufacturer</td></tr>
</table>

Appendix C. Standard Irrigation Kit Details

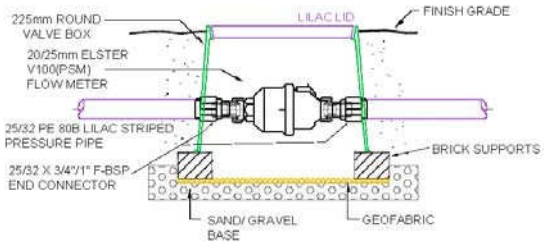
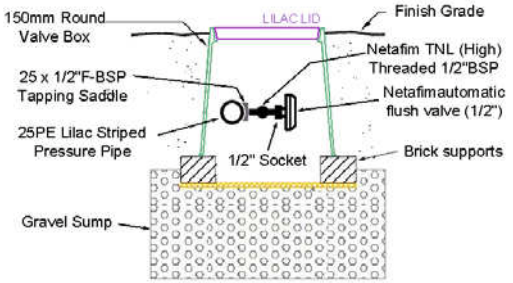
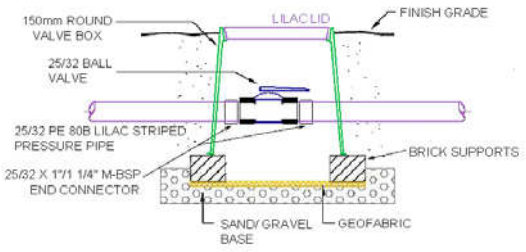
Safe T Flow, Safe T Flow High Flow and Safe T Flow Low Flow Irrigation Kits

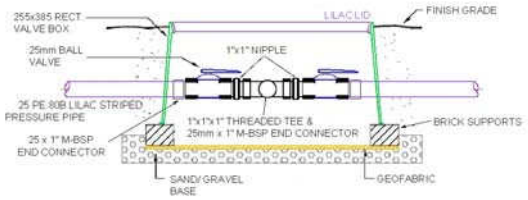
Drip Irrigation Components	Quantity				
	Irrigation Kit Size				
	100	200	300	400	500
Dripline					
SFW 50m dripline kit contains: 50m of dripline, 17mm barb joiner and 16mm ratchet clip (2no). Safe T Flow: SFW383 dripline Safe T Flow Low Flow: SFW267 dripline Safe T Flow High Flow: SFW700 dripline	2	4	6	8	10
PE Pipe					
PE pipe 25mm PN8 Lilac stripe - 25m	1	1	1		
PE pipe 25mm PN8 Lilac stripe - 50m		1	1		
PE pipe 25mm PN8 Lilac stripe -100m				1	1
Miscellaneous					
Tapping Saddle Kit comprises: 25 x ½" tapping saddle with SS bolts, 17mm tail x ½" BSP M director and 16mm ratchet clip (2no)	10	20	20	24	24
Compression Fitting Kit contains: 25x25compression joiner, 25x1"BSP-FI end connector (2no), 25x½" BSP FI compression elbow (2no), 17mm barb elbow (14no), 17mm tail x ½" BSP M director (2no), 16mm ratchet clamp (30no)	1	1	1	1	1
Air Induction Kit contains Netafim Bermad vac release 45430-05, 25 x ½" tapping saddle with SS bolts, Mini Round Valve Box 6"-c/w Lilac Lid	1	1	1	1	1
Irrigation Warning Sign	2	2	2	2	2
Irrigation Sector Repair Kit contains 25x25 compression joiner (2no), 1m length 25PE pipe, 16mm ratchet clamp (10no), 1m length SFW dripline, 17mm barb joiner (5no)	1	1	1	1	1
Note: Maximum number of dripline laterals possible with kit (additional tapping saddle kits required if a greater number of irrigation laterals are required).	6	11	11	13	13

Refer www.biolytix.com for details of dripline kit accessories available. Details of some frequently used dripline kit extras are detailed in Appendix D.

Appendix D. Details of Irrigation Kit Extras

This section provides details on some of the standard Irrigation Kit Extras (or component extras) that may be required for some irrigation layout designs. In additional to the kits scheduled a full range of PE pipe and dripline connection fittings are available.

Irrigation Kit	Details
Flow meter Kit 20mm Flow meter Kit 25mm	Contains Elster 20/25mm V100 flow meter, valve box and fittings suitable to connect to 25PE pipeline Contains Elster V100 flow meter, valve box and fittings suitable to connect to 32PE pipeline 
25 or 32 Air Valve kit	Include, air induction valve, valve box and fittings to connect to 25/32PE pipeline.
Irrigation field flush kit	For irrigation areas where flush return pipeline is unable to return to Biolytix Filter. Includes 6m closing TNL valve. Suitable for sites where static head on valve does not exceed 6m. Fitting provided to connect to 25PE pipeline. Seek detailed design advice if static head exceeds 6m. 
Irrigation field extension kit 50m,100m 150m or 200m x 32PE	32PE PN6.3 lilac striped pipeline and pipe fittings to enable connection to Biolytix Filter and 25PE irrigation pipeline for irrigation distribution and flush – 32x25 Reducer Joiner (2no), 32x 1" F-BSP end connector (2no).
Irrigation sector kit	Suitable for creating another irrigation sector. Contains air valve kit, 25x ½" F-BSP compression elbow (2no), 25mm compression Tee (2no).
Biolytix Soil Moisture Switch	Irrigation control switch (240v) that operates when subsoil saturation occurs. Kit excludes electrical conduit and cabling.
Sign Effluent Reuse Area	Sign indicating that effluent irrigation lines are below ground in the area
Valve Kit 25 or 32mm.	Includes, 25mm/32mm PVC Ball valve, connection fittings to suit 25/32PE pipe and valve box. 

Irrigation Kit	Details
Valve Kit 2 x 25mm ball valve and tee	2x 25mm PVC Ball valves and Tee suitable for connection to 25PE pipeline, includes standard rectangular lilac cover valve box. 
Waterotor 2, 3, 4 or 6 port kit	Allows automatic indexing between each irrigation zone. Includes valve box and all fittings pre-installed ready for direct connection to 25PE pipeline (compression fitting already installed).
SFW267, 383 or 700 dripline kit (50m)	Kit contains 50m roll of Safe T Flow dripline and 1 joiner (barb joiner and ratchet clamps). Allows additional dripline to be easily added to standard drip kits to make up an intermediate size kit e.g. effectively would turn a Safe T Drip 300 kit into a Safe T Drip 350 kit.
Tapping Saddle 4 or 10 kit	4 or 10 Tapping saddles and directors for Safe T Drip Irrigation Kits. Required where additional dripline pipeline laterals are to be installed (above the number available in standard dripline kits.
Irrigation non return valve kit	Contains non return valve, valve box and fittings suitable to connect to 25PE pipeline. May be required in two zone irrigation systems where flush return pipeline returns to Biolytix Filter – refer Appendix I.

Appendix E. Alternative design approach to AS 1547:2000

Biolytix Technologies (BT) promote subsurface land application systems that meet or exceed the performance requirements of AS/NZS 1547, On site domestic-wastewater management, to enable treated effluent discharged from the Biolytix Filter to be effectively managed. Clause 1.4.2 of AS/NZS 1547 allows the use of innovative and alternative materials, systems and methods that meet the performance requirements of the standard. Due to the unique features of the Biolytix Filter and to facilitate site construction, alternative methods and procedures different to AS/NZS 1547 are adopted by Biolytix and this document provides details of these (refer table below).

Table 3: Modifications to AS1547

Ref	AS/NZS 1547 Clause Details	Bioltyix Technologies Amendments
4.5.6.2	*Pump Systems*	Commissioning procedure for pumping system covered by Biolytix Standard Operating Procedure - SOP026 (as included in State Government accreditation approval documentation).
4.5C3.3	Installation – Solids, soil and water	
4.5C3.3 (a)	In-line strainers (150-200 mesh) shall be provided on the pump discharge to protect pipework from any effluent solids carried over from the wastewater-treatment unit into the irrigation lines and to facilitate system servicing.	No strainer is provided on the pump discharge as the Biolytix Filter final layer provides filtration to a higher standard than a 150-200 mesh.
4.5C4	Pre-Commissioning Tests	
4.5C4 (c)	Check effluent dripper system to ensure water flows uniformly from all perforations and that all flushing valves and other fittings are operating correctly.	It is not practical to check operation of all perforations before covering of dripline, as this would require several hundred metres of dripline to remain exposed until the Biolytix Filter is commissioned.
4.5C4 (d)	Record time taken to pump from “pump-on” to the pump-off level. This shall be approximately 3 minutes. Record time in on-system log.	The normal dosing duration for the Biolytix Filter will be 6 to 12 minutes, subject to the final design layout of the treatment plant and irrigation area. The pump flow rate required is governed by the dripper selection and irrigation area. The Biolytix Filter has a sump storage volume of approximately 200 litres (as recommended by clause 4.5C3.1) and a longer discharge time (i.e. compared to specified time of approximately 3 minutes) provides a greater time for soil to absorb the pumped volume.

Appendix F. Subsurface Drip Irrigation Design Form

Completing the questions in Table 4 assists with the design of a subsurface drip irrigation area suitable for use with a Biolytix Filter – BF6. The notes contain references where appropriate to Australian Standard; AS/NZS 1547: On-site domestic-wastewater management. The information is provided as a guide only. Regulatory authorities should be contacted for special design requirements (e.g. some authorities may specify minimum setback distances). Detailed engineering design may be required for complex irrigation systems.

Table 4: Drip Irrigation Design Summary for Biolytix Filter BF6

Ref	Parameter		*Notes*
1	Quantity of Effluent to be dispersed each day – (if irrigation area required is already known go to 3)	L/day	*If not specified by local authority, flow rate to be calculated based on number of bedrooms and/or expected occupancy (persons/day). Table 1 provides indication of flow rate based on number of bedrooms. Normal wastewater flow varies 180-220L/person/day – refer Appendix 4.2D AS/NZS1547.*
2	Soil category number to AS/NZS1547		*Based on soil analysis – refer AS/NZS 1547 for details. Soil assessors to have appropriate qualifications (e.g. have attended the appropriate accredited training programme).*
3	Minimum irrigation area required.	m^2	*Refer Appendix H.* *Minimum irrigation area is to comply with regulatory requirements. Normally irrigation area would be provided by geotechnical consultant.*
4	Slope of irrigation area	1m in… m	*AS/NZS 1547 Clause 4.5C2 recommends benching of sites with grades exceeding 1:20.* ***For sites exceeding 1:20 specialist advice may be required to determine optimum solution*** *(e.g. increase irrigation area above minimum, increase dripline spacing moving down slope).* *Benching to 1:20 is not normally practical on sloping sites and would normally result in a large excavated volume of material. The unique features of Safety Flow dripline (e.g. geofabric wrap, pressure compensating and non leak dripper) assist to promote even distribution of effluent even over sloping sites. Major issue with steeper slopes will be installation difficulties associated with the safe use of mechanical plant. If sections of the irrigation area have a static pressure head exceeding 10m (i.e. level difference between top and bottom of irrigation pipe network exceeds 10m) then sections of the dripline will drain down on pump stoppage, resulting in a higher flow to lower areas of the irrigation area. A more detailed design review would be appropriate in this circumstance.*
5	Elevation difference, Biolytix filter to: a) highest point in irrigation area. b) lowest point in irrigation area	……m ……m	*Maximum positive level difference is required to determine pump static head.* *On some sites elevation may decrease. For sites with elevation decreases exceeding 5m a design check is required to ensure pressures do not exceed pressure rating of pipework. Refer also comments item 4.*

Ref	Parameter		*Notes*
6	Dripline (lateral) spacing (refer Figure 1 and Figure 2)	m	*AS/NZS 1547, Clause 4.5C3.2(f): states maximum spacing shall be 1000mm in clay soils and 600mm in sand.* *IWT research has demonstrated that a wider dripline spacing is possible to that recommend in AS/NZS1547 (refer IWT specification Appendix B) with spacing up to 1.5m wide in sand and 2m in clay soils. Typically a 1.5m spacing is likely to be appropriate for most sites with an installation depth of 150mm approximately. Closer spacings (i.e. aprox. 700mm) would be required to assist in uniform irrigation of grass/turf vegetation cover and to mitigate against striping effect in irrigated area..*
7	Total length of dripline required	m	*Item 3/ Item 4*
8	Distribution pipeline selection		*25PE80 PN8 Lilac striped pressure pipe should suit most applications* *32PE80 PN6.3 may be required for sites where a long distribution pipeline is required or where irrigation area is uphill (typically greater than 10m) of Biolytix Filter (refer Appendix G selection tables).*
9	Flush return pipeline selection		
10	Dripline Selection		*Refer Appendix F selection tables. Most residential sites should only be single zone. For multiple zone sites refer also Appendix I for some possible layout arrangements..*
11	Number of Irrigation Zones Required		
12	Minimum number of dripline laterals	No	*Refer Appendix G. Refer explanatory notes prior to using tables.* *Refer Biolytix/ Irrigation designer for applications outside the ranges covered in the Appendix G tables. Tables assume a standard Biolytix Filter pump and a minimum 0.3m/s flush velocity).*
13	Maximum number of dripline laterals	No	
14	Maximum length of dripline lateral	m	*Item 5/Item 10*
15	Minimum length of dripline lateral	m	*Item 5/Item 11*
16	Dripline Installation Depth	mm	*AS/NZS 1547, Figure 4.5C1 recommends installation depth varying 100-150mm. Refer also IWT Safety Flow specification, Appendix B. Deeper installation depth required when wide dripline spacing is adopted.*

Ref	Parameter		*Notes*
17	Sketch irrigation pipework layout drawing.		*Ensure maximum dripline lateral lengths are not exceeded. Refer Figure 1 and Figure 2 for typical layouts. The typical layout drawings are provided based on single irrigation zones. Multiple zones may be required for large irrigation areas. Biolytix supply a distribution valve (hydraulically operated) that automatically switches between irrigation zones each time the irrigation system pump operates. Refer Appendix I for typical multiple zone irrigation areas.* *Detailed design advice will be required if subsurface drip irrigation system is proposed with UV disinfection system as flow rate needs to be limited to capacity of UV lamp.*
18	**Dripline Kit Selection** (e.g. Safe T Drip 300)		*Selection tables provided with this guide document assume Safety Flow dripline. Refer Appendix B and Appendix C (Biolytix standard subsurface dripline kits).*
19	**Dripline Kit – Additional Items**		*For sites with unusual layouts additional fittings may be required to complement a standard Biolytix irrigation kit. Biolytix provide a range of dripline component kits to supplement the main irrigation kits (e.g. additional air valves, pipe lengths and pipe fittings). Refer Appendix D for details of some standard irrigation extras available.*

Appendix G. Dripline Selection Tables

The following explanatory notes should be read prior to using the selection tables.

The selection tables in this appendix provide the minimum and maximum number of irrigation pipe laterals appropriate for an irrigation area, given:

- Dripline type, either SFW700, SFW383 and SFW267. Refer Appendix B for dripline specifications. Three types of irrigation kits are available that include these driplines. Safe T Drip contains SFW383, Safe T Drip low flow contains SFW267 and Safe T Drip High flow contains SFW700.
- Total dripline length (refer Table 4, Ref 7). For dripline lengths not provided a conservative higher dripline length should be assumed.
- Size and length of distribution and flush pipelines (refer Table 4, Refs 8 and 9). Multiple solutions are available for 25PE and 32PE pipeline. Typically a 25PE pipeline should be selected wherever possible. Where suitable distribution and flush pipe length do not exist the more conservative longer pipe length selection table should be adopted (alternatively a detailed design would need to be undertaken).
- Maximum level rise in the irrigation area (refer Table 4, Ref 5). If level drops from Biolytix Filter to irrigation area a level rise of 0m should be assumed.

The tables assume:

- Each dripline lateral length will be approximately equal (i.e. allows for a uniform flush velocity in each lateral of 0.3m/s minimum).
- The irrigation area is relatively uniform. Irrigation areas with several metres difference in level (typically >5m) may require a more detailed design review (refer Table 4, Refs 4 and 5). When the difference in level exceeds 5m it is likely that the dripline emitters will be open during the flushing event. In this instance the more conservative bracketed term e.g. (15) in the selection tables should be adopted. Bracketed details also include, the term 2fz – this term implies 2 flush zones are required to ensure minimum flush velocity is obtained. This solution would require manual valves to be installed and pipework designed so that the irrigation area may be split into 2 during a manual flushing event. Under normal circumstances the 2 flush zone option should not be necessary as it is a lower flow dripline would provide an alternative solution.

Distribution Pipe	25PE	30m
Flush Pipe	25PE	30m

Max Rise (m)	0m						5m					
Dripline	SFW 700		SFW 383		SFW 267		SFW 700		SFW 383		SFW 267	
Total	Laterals		Laterals		Laterals		Laterals		Laterals		Laterals	
Length (m)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
100	1 (1)	16 (15)					1 (1)	16 (13)				
200	2 (2)	16 (12)	2 (2)	16 (15)			2 (2)	16 (10)	2 (2)	16 (13)		
300	3 (4)	16 (8)	2 (2)	16 (13)	2 (2)	16 (14)	4 (5)	16 (6)	2 (2)	16 (12)	2 (2)	16 (13)
400	5 (5)	16 (24-2fz)	3 (3)	16 (11)	2 (3)	16 (13)	10 (10-2fz)	16 (20-2fz)	3 (3)	16 (10)	2 (3)	16 (12)
500	Multiple Zones		4 (4)	16 (10)	3 (3)	16 (12)	Multiple Zones		4 (4)	16 (8)	3 (3)	16 (10)
600			5 (6)	16 (7)	3 (4)	16 (11)			5 (4-2fz)	16 (24-2fz)	3 (4)	16 (9)
700			6 (6-2fz)	16 (24-2fz)	4 (5)	16 (9)			9 (9-2fz)	16 (22-2fz)	4 (6)	16 (6)
800			9 (9-2fz)	16 (22-2fz)	4 (4-2fz)	16 (26-2fz)			2 Zones		5 (6-2fz)	16 (24-2fz)
900			2 zones		5 (5-2fz)	16 (24-2fz)					6 (6-2fz)	16 (22-2fz)
1000					6 (6-2fz)	15 (24-2fz)					2 Zones	
1100					8 (8-2fz)	15 (20-2fz)						
1200					2 zones							

Distribution Pipe	25PE	50m
Flush Pipe	25PE	50m

Max Rise (m)	0m						5m					
Dripline	SFW 700		SFW 383		SFW 267		SFW 700		SFW 383		SFW 267	
Total	Laterals		Laterals		Laterals		Laterals		Laterals		Laterals	
Length (m)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
100	1 (1)	13 (12)					1 (1)	13 (11)				
200	2 (2)	13 (9)	2 (2)	13 (12)			2 (3)	12 (8)	2 (2)	13 (11)		
300	4 (4-2fz)	12 (22-2fz)	2 (2)	12 (10)	2 (2)	12 (11)	4 (4-2fz)	12 (18-2fz)	2 (2)	12 (9)	2 (2)	12 (10)
400	11 (11-2fz)	12 (18-2fz)	3 (3)	12 (9)	2 (2)	12 (10)	Multiple Zones		3 (3)	12 (7)	2 (3)	12 (9)
500	Multiple Zones		4 (4)	12 (6)	3 (3)	12 (9)			4 (4-2fz)	12 (20-2fz)	3 (3)	12 (7)
600			5 (4-2fz)	12 (20-2fz)	3 (4)	12 (8)			7 (8-2fz)	12 (18-2fz)	4 (5)	12 (5)
700			2 Zones		4 (4-2fz)	12 (22-2fz)			2 Zones		4 (4-2fz)	12 (20-2fz)
800					5 (5-2fz)	12 (20-2fz)					6 (2fz)	12 (18-2fz)
900					6 (6-2fz)	12 (20-2fz)					2 Zones	
1000					10 (10-2fz)	12 (18-2fz)						
1100					2 Zones							

Distribution Pipe	25PE	50m
Flush Pipe	25PE	50m

Max Rise (m)	10m						15m					
Dripline	SFW 700		SFW 383		SFW 267		SFW 700		SFW 383		SFW 267	
Total	Laterals		Laterals		Laterals		Laterals		Laterals		Laterals	
Length (m)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
100	1 (1)	12 (9)					2 (2)	10 (8)				
200	3 (3)	(12) 6	2 (2)	12 (9)			4 (4-2fz)	10 (16-2fz)	2 (2)	10 (8)		
300	Multiple Zones		3 (3)	12 (7)	2 (2)	12 (9)	Multiple Zones		3 (3)	10 (6)	2 (2)	10 (7)
400			4 (4)	12 (5)	3 (3)	12 (7)			7 (7-2fz)	10 (16-2fz)	3 (4)	10 (5)
500			7 (7-2fz)	12 (16-2fz)	3 (4)	12 (5)			Multiple Zones		5 (5-2fz)	10 (16-2fz)
600			2 Zones		4 (4-2fz)	12 (18-2fz)					Multiple Zones	
700					7 (7-2fz)	12 (16-2fz)						
800					2 Zones							
900												
1000												

Distribution Pipe	32PE	50m
Flush Pipe	32PE	50m

Max Rise (m)	10m						15m					
Dripline	SFW 700		SFW 383		SFW 267		SFW 700		SFW 383		SFW 267	
Total	Laterals		Laterals		Laterals		Laterals		Laterals		Laterals	
Length (m)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
100	1 (1)	19 (16)					2 (2)	17 (14)				
200	3 (3)	19 (12)	2 (2)	19 (15)			3 (3)	17 (10)	2 (2)	17 (13)		
300	4 (4)	19 (8)	3 (3)	19 (14)	2 (2)	19 (15)	7 (7-2fz)	17 (24)	3 (3)	17 (12)	2 (2)	17 (13)
400	Multiple Zones		3 (3)	19 (12)	2 (3)	19 (14)	Multiple Zones		4 (4)	17 (10)	3 (3)	17 (11)
500			4 (4)	19 (10)	3 (3)	19 (12)			6 (6-2fz)	16 (26-2fz)	4 (4)	16 (10)
600			6 (6-2fz)	18 (28-2fz)	4 (4)	19 (11)			2 Zones		6 (6)	16 (7)
700			10 (10-2fz)	18 (26-2fz)	5 (6)	19 (8)					7 (7-2fz)	16 (24-2fz)
800			2 Zones		6 (6-2fz)	18 (28-2fz)					2 Zones	
900					7 (7-2fz)	18 (26-2fz)						
1000					13 (13-2fz)	18 (26-2fz)						
1100					2 Zones							

Distribution Pipe	25PE	100m
Flush Pipe	25PE	100m

Max Rise (m)	0m						5m					
Dripline	SFW 700		SFW 383		SFW 267		SFW 700		SFW 383		SFW 267	
Total	Laterals		Laterals		Laterals		Laterals		Laterals		Laterals	
Length (m)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
100	1 (1)	12 (8)					1 (1)	9 (7)				
200	2 (3)	9 (5)	2 (2)	9 (8)			3 (3)	9 (4)	2 (2)	9 (7)		
300	6 (6-2fz)	8 (14-2fz)	2 (2)	8 (7)	2 (2)	8 (8)	Multiple Zones		2 (3)	8 (6)	2 (2)	8 (8)
400	Multiple Zones		3 (3-2fz)	8 (16-2fz)	2 (3)	8 (7)			4 (4-2fz)	8 (14-2fz)	2 (3)	8 (5)
500			5 (5-2fz)	8 (14-2fz)	3 (4)	8 (5)			Multiple Zones		3 (3-2fz)	8 (14)
600			2 Zones		4 (4-2fz)	8 (16-2fz)					4 (4-2fz)	8 (14)
700					5 (5-2fz)	8 (14-2fz)					2 Zones	
800					2 Zones							
900												
1000												

Distribution Pipe	32PE	100m
Flush Pipe	32PE	100m

Max Rise (m)	0m						5m					
Dripline	SFW 700		SFW 383		SFW 267		SFW 700		SFW 383		SFW 267	
Total	Laterals		Laterals		Laterals		Laterals		Laterals		Laterals	
Length (m)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
100	1 (1)	19 (17)					1 (1)	18 (15)				
200	2 (2)	19 (14)	2 (2)	19 (16)			2 (2)	18 (12)	2 (2)	18 (15)		
300	3 (4)	19 (10)	2 (2)	19 (15)	2 (2)	19 (16)	4 (4)	18 (8)	2 (2)	18 (13)	2 (2)	18 (14)
400	5 (5-2fz)	19 (28-2fz)	3 (3)	19 13)	2 (2)	19 (15)	7 (7-2fz)	18	3 (3)	18 (11)	2 (3)	18 (13)
500	Multiple Zones		3 (4)	19 (11)	3 (3)	19 (14)	Multiple Zones		4 (4)	18 (9)	3 (3)	18 (12)
600			4 (5)	19 (9)	3 (4)	19 (12)			5 (5-2fz)	18 (26-2fz)	3 (4)	18 (10)
700			6 (6-2fz)	19 (28-2fz)	4 (4)	19 (11)			7 (7-2fz)	17 (22-2fz)	4 (5)	17 (8)
800			7 (7-2fz)	18 (26-2fz)	4 (5)	18 (9)			2 Zones		5 (5-2fz)	17 (26-2fz)
900			2 Zones		5 (5-2fz)	18 (28-2fz)					6 (6-2fz)	17 (24-2fz)
1000					6 (6-2fz)	18 (28-2fz)					8 (8-2fz)	17 (24-2fz)
1100					7 (7-2fz)	18 (26-2fz)					2 Zones	
1200					10 (10-2fz)	18 (24-2fz)						
1300					2 Zones							

Distribution Pipe	32PE	100m
Flush Pipe	32PE	100m

Max Rise (m)	10m						15m					
Dripline	SFW 700		SFW 383		SFW 267		SFW 700		SFW 383		SFW 267	
Total	Laterals		Laterals		Laterals		Laterals		Laterals		Laterals	
Length (m)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
100	1 (1)	16 (13)					2 (2)	14 (11)				
200	3 (3)	16 (10)	2 (2)	16 (13)			3 (3)	14 (11)	2 (2)	14 (11)		
300	5 (5-2fz)	16 (22)	3 (3)	16 (11)	2 (2)	16 (12)	Multiple Zones		3 (3)	14 (9)	2 (2)	14 (10)
400	Multiple Zones		3 (3)	16 (9)	2 (3)	16 (11)			5 (5)	14 (7)	3 (3)	14 (9)
500			5 (5)	16 (7)	3 (4)	16 (10)			10 (10-2fz)	14 (20-2fz)	4 (4)	14 (7)
600			7 (7-2fz)	16 (22)	4 (5)	16 (24)			Multiple Zones		6 (6-2fz)	13 (20-2fz)
700			2 Zones		5 (5-2fz)	16 (8)					2 Zones	
800					6 (6-2fz)	16 (22-2fz)						
900					12 (12-2fz)	16 (20-2fz)						
1200					2 Zones							
1300												

Distribution Pipe	32PE	200m
Flush Pipe	32PE	200m

Max Rise (m)	0m						5m					
Dripline	SFW 700		SFW 383		SFW 267		SFW 700		SFW 383		SFW 267	
Total	Laterals		Laterals		Laterals		Laterals		Laterals		Laterals	
Length (m)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
100	1 (1)	13 (12)					1 (1)	13 (11)				
200	2 (2)	13 (10)	2 (2)	13 (12)			2 (3)	13 (8)	2 (2)	13 (11)		
300	4 (4)	13 (5)	2 (2)	13 (11)	2 (2)	13 (12)	4 (4-2fz)	13 (20-2fz)	2 (2)	13 (9)	2 (2)	13 (11)
400	8 (8-2fz)	13 (20-2fz)	3 (3)	13 (9)	2 (2)	13 (11)	Multiple Zones		3 (4)	13 (8)	2 (3)	13 (9)
500	Multiple Zones		4 (4)	13 (7)	3 (3)	13 (10)			4 (4-2fz)	13 (20)	3 (3)	13 (8)
600			5 (5-2fz)	13 (22-2fz)	3 (4)	13 (8)			7 (7-2fz)	13 (18)	4 (5)	13 (6)
700			8 (8-2fz)	13 (20)	4 (4-2fz)	13 (22)			2 Zones		4 (4-2fz)	13 (20-2fz)
800			2 Zones		5 (5-2fz)	12 (22)					6 (6-2fz)	13 (18-2fz)
900					6 (6-2fz)	12 (20)					11 (11-2fz)	18 (18-2fz)
1000					8 (8-2fz)	12 (20)					2 Zones	
1100					2 Zones							

Distribution Pipe	32PE	200m
Flush Pipe	32PE	200m

Max Rise (m)	**10m**						**15m**					
Dripline	**SFW 700**		**SFW 383**		**SFW 267**		**SFW 700**		**SFW 383**		**SFW 267**	
Total	**Laterals**		**Laterals**		**Laterals**		**Laterals**		**Laterals**		**Laterals**	
Length (m)	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
100	1 (1)	12 (10)					2	11 (8)				
200	3 (3)	12 (6)	2 (2)	12 (9)			4	11 (4)	2 (2)	11 (8)		
300	9 (9-2fz)	12 (6)	3 (3)	12 (8)	2 (2)	12 (9)	Multiple Zones		3 (3)	11 (6)	2 (2)	11 (7)
400	Multiple Zones		4 (4)	12 (6)	3 (3)	12 (8)			6 (6-2fz)	10 (16-2fz)	3 (3)	10 (6)
500			6 (6-2fz)	12 (18-2fz)	3 (4)	12 (6)			Multiple Zones		5 (52fz)	10 (16)
600			Multiple Zones		4 (4-2fz)	12 (18)					2 Zones	
700					7 (7-2fz)	12 (16)						
800					2 Zones							
900												

Notes:

1. Selection Tables based on using Safe T Flow dripline with Biolytix Filter BF6 pumping system (Pedrollo Sumo 2/5 pump).
2. Max rise refers to maximum height of drip irrigation area above top of Biolytix Filter (refer Figure 1)
3. Refer Appendix B for details on standard irrigation kits. Note irrigation kits do not normally include sufficient fittings for maximum dripline laterals.

Appendix H. Irrigation Area Selection Guide

		Soil Category (AS/NZS 1547)					
		1	2	3	4	5	6
		Gravels & Sands	Sandy Loams	Loams	Clay Loams	Light Clays	Med/H Clay
Irrigation Rate (mm/week)		35	35	28	25	20	15
Flow (L/day)	Typ. No. of Bedrooms						
200		40	40	50	56	70	93
300		60	60	75	84	105	140
400		80	80	100	112	140	187
500		100	100	125	140	175	233
600	3	120	120	150	168	210	280
700	3	140	140	175	196	245	327
800	3	160	160	200	224	280	373
900	3	180	180	225	252	315	420
1000	3	200	200	250	280	350	467
1100	4	220	220	275	308	385	513
1200	4	240	240	300	336	420	560
1300	4	260	260	325	364	455	607
1400	4	280	280	350	392	490	653
1500	5	300	300	375	420	525	700
1600	5	320	320	400	448	560	747

Notes:

1. Irrigation rates from AS/NZS 1577, Table 4.2A4.

2. Typical numbers of bedrooms based on AS/NZS 1577, Table 4.2D.

3. Refer AS/NZS 1577, Table 4.2D for typical wastewater flow allowance in L/person/day.

Appendix I. Multi-Zone Irrigation Layout Drawings

The following schematic layout drawings provide possible details of irrigation fields that require multiple zones. To determine the maximum and minimum length of irrigation zone laterals the design tables provided in Appendix G may also be used. Design details would need to be based on the irrigation zone located furthest from the Biolytix Filter or the zone at the highest elevation (i.e. whichever results in the more rigorous requirement).

Figure 3 provides a schematic drawing of a 2 zone irrigation area with the flush pipeline returning to the Biolytix Filter. A detailed drawing would be required to determine actual irrigation kit component requirements. Typically in additional to a standard irrigation kit the following additional items are likely to be required:

- 2 Zone Waterotor Kit (automatically indexes flow sequentially between both irrigation zones.
- Non return valves, to prevent backflow to each irrigation zone from flush header pipeline.
- Air valves (standard irrigation kit is unlikely to have sufficient air valves.
- Tee connection and other miscellaneous polyethylene pipe fittings to suit irrigation layout.

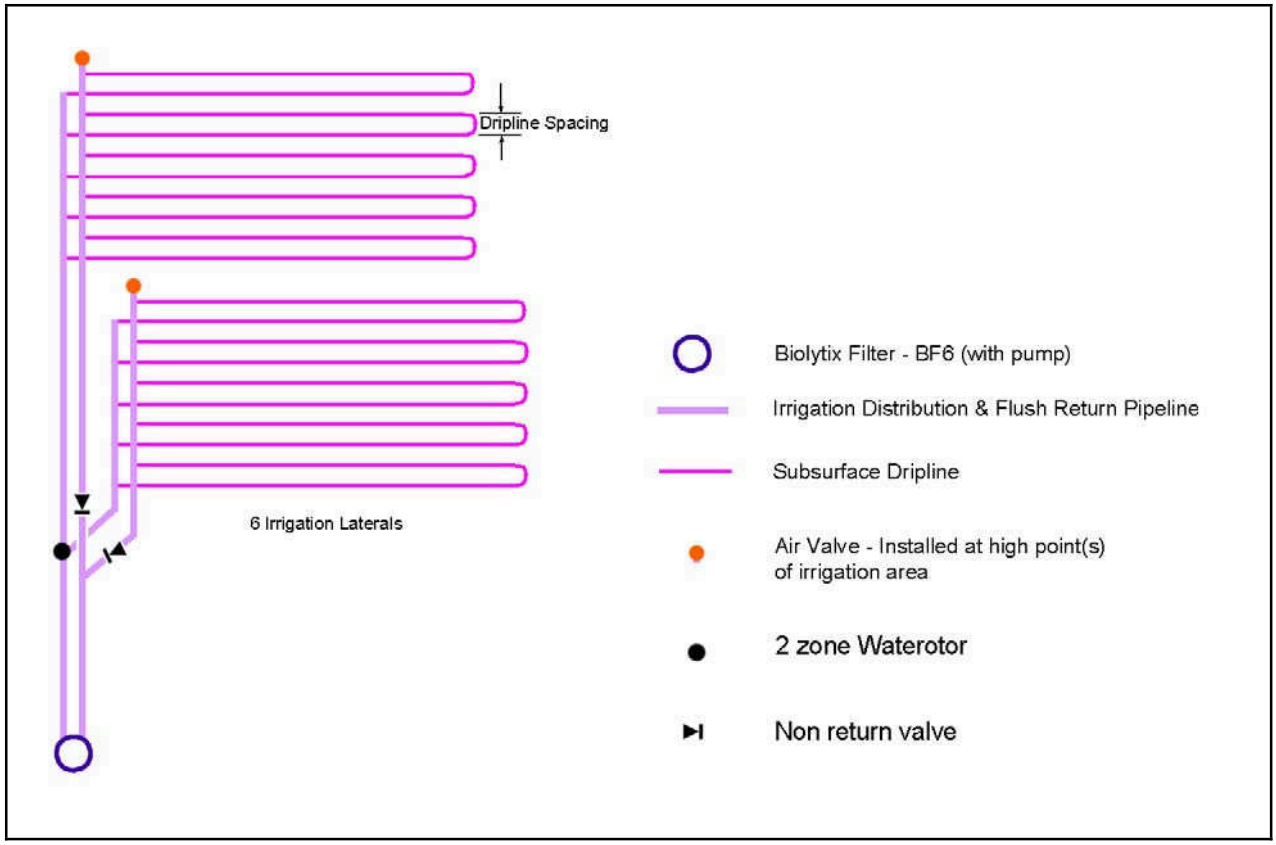

Dripline Spacing
6 Irrigation Laterals
Biolytix Filter - BF6 (with pump)
Irrigation Distribution & Flush Return Pipeline
Subsurface Dripline
Air Valve - Installed at high point(s) of irrigation area
2 zone Waterotor
Non return valve

Figure 3 Schematic Drawing of 2 Zone Irrigation Area – Flush Return to Biolytix Filter

Figure 4 indicates a multiple zone irrigation area. A Waterotor is capable of irrigating directly to 2, 3,4 and 6 zones. With multiple zones it is unlikely that the flush return pipeline would return to the Biolytix Filter due to the complexity of pipework required and infield flush valves would be

installed. Similar to a 2 zone design, a multiple zone irrigation area would need to be detailed to scale to determine the length and number of irrigation components required.

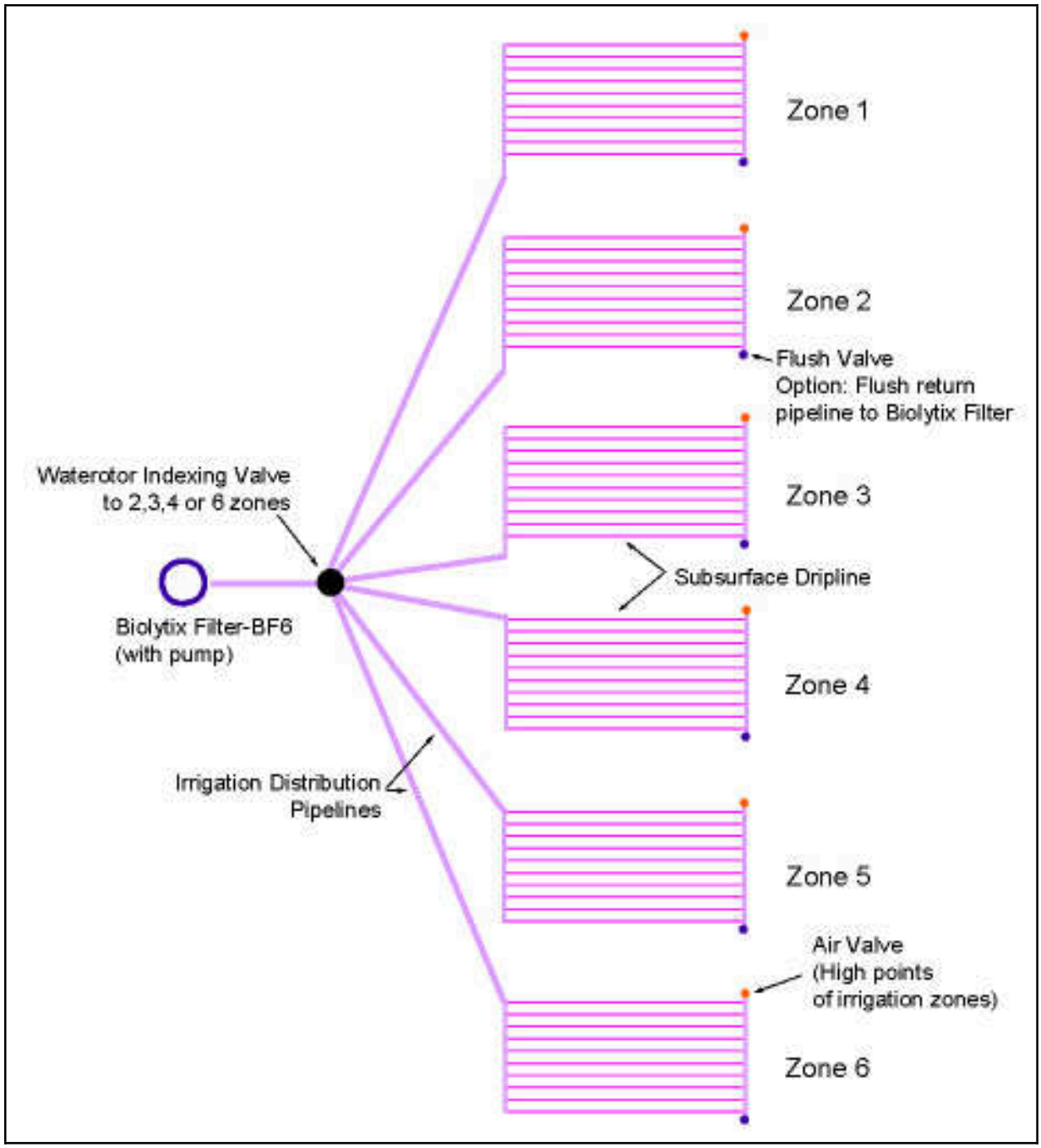


Figure 4 Multi-Zone Irrigation Schematic: In-field Flush Valves

Appendix J. Subsurface Dripline Construction Details

1	**Preconstruction Notes**
1.1	Pipeline Fittings: Match fittings against design drawings to ensure all equipment has been supplied prior to commencing any excavation work.
1.2	Fittings should include: • Dripline – normally pressure compensating and colour coded to suit wastewater application. • Distribution and Flush Manifold Pipework: Normally polyethylene pipe with lilac stripes. • Air valve(s), normally minimum 2 • Pipe fittings Note: Flush valves and flush return valve are pre-installed within the Biolytix Filter.
1.3	Handle pipes and fittings in accordance with manufacturer's written requirements.
1.4	Utilities: Ensure there are no existing utilities within the irrigation area, including cables and service pipework.
2	**Site Preparation**
2.1	Stormwater: The ingress of surface and seepage water into the land application area shall be controlled or prevented. On sloping sites a cut off trench shall be constructed up-slope to divert surface and groundwater away from the irrigated area. Construction of drains should be in accordance with regulatory authority requirements.
2.2	Any site preparation work, including site leveling and filling operations should be completed prior to installation of irrigation equipment. As soon as installation works commence the area is classified as an effluent irrigation area with the following limitations: • No future expectation of building(s), decks, or other impervious surfaces • No long term storage of equipment or vehicles over the site • A permanent vegetative cover. Install barriers and signage as necessary to restrict vehicular access into irrigation field. The area should be fenced if there is an opportunity for traffic to regularly enter area causing road/paths to develop within the irrigation field.
2.3	In soil conditions that are particularly dry, moisten the soil the day before (where possible) to facilitate construction works.
2.4	Do not install system in saturated soils.
3	**Dripline Installation**
3.1	Mark all corners of the irrigation field. Generally the top corners should be at the same level. The bottom corners should also be at approximately the same level. Mark out location of all distribution and dripline pipework (e.g. marking

	paint or similar). Generally dripline should be laid to follow land contours. Some minor adjustment to the design layout may be required to achieve the required dripline spacing, whilst achieving an approximate level grade. If it is not possible to achieve an even grade the dripline should be appropriately graded to ensure any trapped air may rise to the nearest air valve(s).
3.2	Install the irrigation supply manifold from the Biolytix Filter (and the flush manifold where it is located within the same trench). The depth of the manifold at dripline connections would normally be installed at the same depth as the driplines to enable the air valves to operate effectively. Manifold pipework is to be flushed before connection of dripline if it has become contaminated during drilling for tapping saddles.
3.3	Install each dripline lateral from the distribution manifold spaced in accordance with the design details (e.g. by plowing, trenching or fill techniques). The installation method should avoid placing excessive stress on the dripline tubing. Cut each lateral approximately 300mm above ground level at the location of the flush manifold pipework (if flush manifold is to be installed). Use thread tape on all screw fittings. Depth of burial is to be consistent throughout the field and would normally be 100mm depth of cover. It is necessary to keep the pipe shallow to ensure effluent uptake by plants, however in sand depth may be 150mm. Ensure loose debris/ dirt cannot enter pipeline(s) and provide temporary pipe covers as necessary.
3.4	Install air valves (in valve pits) at highest points within the system in accordance with design drawings (use thread tape). Valve pits should be free draining to prevent flooding (e.g. located over 200 thick pea gravel or similar).
3.5	Install automatic flush valve (if not already pre-installed within Biolytix Filter), normally installed at lowest level on flush manifold or at end of each dripline lateral (subject to design layout)
3.6	Fill Biolytix filter with fresh water and turn on pump. Check for flow out the ends of all dripline. Let the pump run for about 5 minutes to flush out any debris from pipeline.
3.7	Install flush manifold including any isolation valves and connect dripline laterals.
3.8	Commission pipeline in accordance with Biolytix Filter commissioning procedures.
4	**Commissioning Notes**
4.1	Open the flush or isolation valves and operate pump to flush lines and then close the valve and check the field and all piping and connections for leaks. Turn off the system.
4.2	Do not start the system with a large dose that may create preferential water passages to the surface. The commissioning phase should adopt dose rates not dissimilar to that required in normal operation. In particularly dry fields, commissioning may be assisted by dampening the field (if spray irrigation water source is available) prior to commencing the initial irrigation.
4.3	Complete final as-built diagrams, flow measurements and pressure readings at

	startup.
5	**System Maintenance**
5.1	To ensure trouble free operation of the irrigation field regular performance monitoring of the field is required. Performance monitoring should be carried out in accordance with regulatory requirements and not less than 6 month intervals.
5.2	Visually check and report the condition of the drip field, including any noticeable wetness. Some possible problem symptoms include: • Water surfaces continuously at one or more isolated spots (indicating possible localized damage to dripline). • Portion of irrigation area is saturated while other areas are relatively dry (indicating possible blockage or pump operational problems). • Entire irrigation area appears saturated (indicating possible overloading of irrigation area)
6	**Operational Notes**
6.1	Landscaping to be established immediately (e.g. grass cover) to stabilize soil and allow for the vegetation to take up the water.
6.2	Maintain plumbing fixtures to ensure excess water does not enter wastewater treatment system, overloading the Biolytix Filter and irrigation area.
6.3	Do not drive vehicles or heavy equipment over the drip irrigation area. Lawn mowers and light equipment may be driven over the field.
6.4	Do not drive tent stakes, excavate etc within irrigation area.